FOOD MANUFACTURE

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FOOD MANUFACTURE

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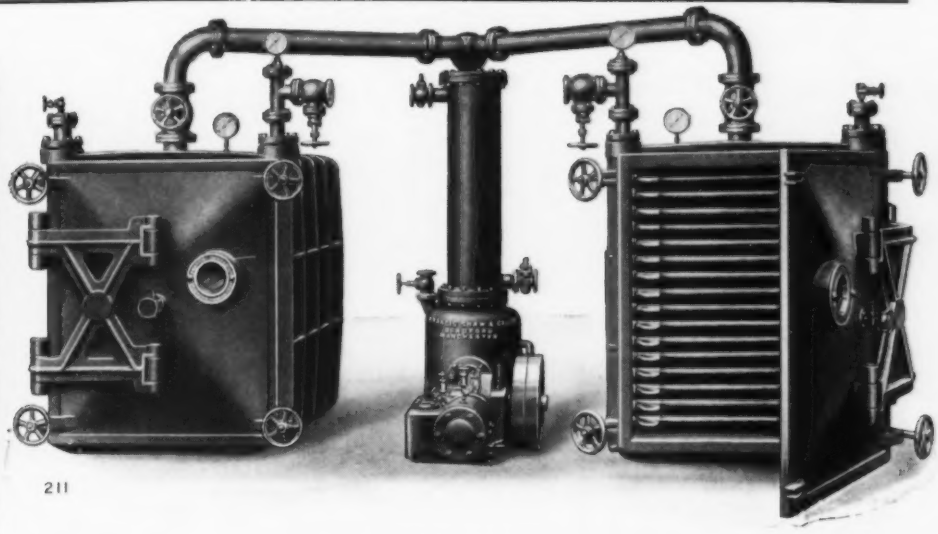

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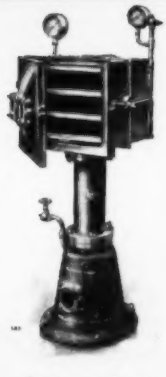

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FOOD MANUFACTURE

Vol. XV, No. 7 July 5, 1940

Food Policy

THE GOVERNMENT'S food policy has received some severe handling in the Report of the Select Committee on National Expenditure recently published by H.M. Stationery Office. The food supply of this country has been determined by the joint effort of the Ministers of Food, Agriculture and Shipping, and, in the absence of the Ministry of Health, very little attention seems to have been paid to the nutritional side of the problem. The Ministry of Food, says the Committee, has grown up piecemeal as the need for each part has become manifest. At the head of each commodity division is an expert in his own particular trade. The policy has been to provide as wide a variety of foods as possible, but where there has been competition between two commodities the balance has been struck by compromise rather than by a scientific decision as to which of the two is more dietetically valuable. The controller of each commodity has sought to do the best he can for his own particular trade, but if the nutrition of the nation is to be put on the best war-time basis some trade interests will have to be sacrificed.

Some Examples and Suggestions

The Committee give sugar as an example. They asked the Ministry of Food whether sugar would not have a better chance of being distributed to the best advantage if it were mixed with cocoa to make chocolate or with fruit to make jam than if it were used in boiled sweets or for icing cakes. The Ministry assured the Committee that this point has been recognised and that chocolate makers had been allotted 70 per cent. of their normal requirements, whereas boiled sweet makers were only allowed 60 per cent.—scarcely a big differentiation. As the report puts it, there was a pull-devil-pull-baker business between the makers of condensed milk and boiled sweets and the pastrycooks. As a solution to the problem the Committee proposed to appoint an authoritative body of scientists and practical men (not, we hope, nutritional cranks) to work out a basic plan of war-time food policy for the country. This would aim at providing an adequate diet with the lowest expenditure of shipping and currency. The Ministry of Agriculture should provide as much as home production could and the Ministry of Shipping do the rest. When supplies were available the Ministry of Food should make sure of fair distribution. This sounds well, but how long will it take to institute this Committee and put its findings into operation? We are engaged in a "blitzkrieg," and our food policy is needed for this war, not the next.

War-time Research

The activities of the Advisory Research Council of the Chemical Society, which was formed last September to act as a liaison between chemists engaged in unremunerative research who are seeking guidance as to subjects for investigation of potential value to the national war effort and Government departments or industrial organisations in a position to suggest such topics, was mentioned by the President of the Society at the annual meeting. The President said that the response to the suggestions made and invitations issued by the Advisory Research Council had been very gratifying, and he was sure that their initiative would continue to receive the generous support of Fellows throughout the Empire. It has been laid down by the Council that the only subjects to be studied should be such as have a definite relation to the conduct of the present war. It is, however, generally agreed that the maintenance of our export trade in a flourishing condition is of the utmost importance, and therefore the Council is prepared to assist the chemical industry as far as lies in its power. In his final remarks the President pointed out that the Council was always available for consultation if any Fellow was doubtful of the proper procedure at any stage of the work. We have no doubt that in addition to pure chemical research, food chemists engaged in research would find this service very helpful.

The Oslo Breakfast

In a recent broadcast, Professor J. C. Drummond, scientific adviser to the Ministry of Food, made the remarkable statement that there was no reason why the people in this country should not emerge from this war better nourished than before. He meant, of course, that due to a certain scarcity of other foodstuffs, and a greater attention to the possibilities of available protective foods, a saner dietary would evolve.

Professor Drummond mentioned the Oslo breakfast, so named after that devised by Professor Schiotz of Oslo. This, as practised in Norway, is composed of one-third litre of unskimmed milk, a Kneipp cracker with margarine and goat's cheese and half an orange, half an apple or one raw carrot, and vegetables according to season.

Dr. Vynne Borland, writing in *The Journal of the Royal Institute of Public Health and Hygiene*, June, 1940, fully describes the experiments carried out by the L.C.C. in replacing the traditional hot mid-day meal (consisting of meat, vegetables, and a pudding) at an East End dining centre with a modification of the Oslo breakfast. The results were remarkable, and it is reported that nearly all the "Health" dinner children showed increased vitality, better concentration, and more educational progress.

British Vegetable Canning

War-time activities of the British canning industry are described in an article in *Tin* for May, in recording the impressions of its one-time pioneer and now a leader, Mr. W. S. Smedley.

Contributed to both by war-time conditions and the shortage and high prices of uncanned vegetables brought about by the exceptionally severe winter, the demand for canned vegetables has been unprecedented during the past few months. "The British public have for the first time discovered the existence of canned English vegetables, and, having discovered them, they like them." The demand, particularly for carrots, has been enormous. Peas, both "garden" and "processed", have been one of the staple products of the British vegetable canneries, but other vegetables are now beginning to overtake them. This year the acreage of celery, spinach, carrots, and stringless beans is being increased by over 100 per cent.

Frosted Foods

We have from time to time made reference to quick-frozen foods, and undoubtedly this process has advantages. From the time of the Garden of Eden human desire has always coveted the forbidden fruit, and people in all ages have hankered after fruits out of season. The earlier methods of satisfying this craving were drying, pickling and, later, cold storage, but nowadays people not only want fruits and vegetables out of season, but with their full natural flavour.

The quick-freezing method has made progress in that direction, and there are few towns and even villages in England where soft fruits and tender vegetables cannot be obtained in mid-winter with almost all the flavour they possessed when picked six months before. These have been quickly frozen at temperatures between zero and 40 deg. below zero and then kept at zero until marketed. So far so good; but natural suspicion of any process of preservation raised the question as to wether the quick-frozen foods have retained any or all of their dietetic as distinct from their gastronomic values. Dr. Mary Rose, a dietitian in the University of Columbia, in a report to the American Medical Association, answers the question emphatically, "Yes—nearly all".

Some Conclusions

In the report (*J. Amer. Med. Assn.*, April 6, 1940) she states that there is no reason why the vitamin C of frosted fruits and vegetables when cooked should be less than those of fresh ones when cooked. In order to keep the full vitamin content the fruit and vegetables should pass rapidly from the orchard or field to the processing plant, where they would be blanched to destroy the ascorbic acid oxidase, and then rapidly frozen and finally cooked without defrosting. It was found that the vitamin A value of such foods remained unchanged for many months. Vitamin B_1 values may decrease if the blanching process is inadequate. There is scarcely any loss of riboflavin. It must be remembered that fruits and vegetables contain very little vitamin B_1 anyway, so that the small loss of this vitamin in frosted foods is insignificant in a normal diet. The main dietetic consideration is that in the winter months supplies of vitamins A and C can be had from frosted vegetables, apricots, tomatoes and other similar foods.

Potted Meat Pastes

"Defendant might just as easily have sold breadcrumbs as potted meat", said the prosecuting counsel in a recent case under the Food and Drugs Act. When analysed, the product was found to contain only 16 per cent. meat, whereas "the generally accepted principle was that there should be 30 per cent. meat". There were also 15 per cent. cereals and 68 per cent. water. For the defendant it was said that "it was generally understood by the customers that the product was 'potted meat paste' and not 'potted meat'. If it had been sold as such when sold to the inspector no offence would have been committed".

We are wondering what proportion of consumers are so familiar with this confusing nomenclature as to know the difference between "potted meat paste" and "potted meat". We should like to see a more distinctive name attached to the "paste" variety.

Rice and Beri-Beri

It is over twenty-five years since Eijkman and his co-workers clearly demonstrated the connection between the consumption of highly milled rice and beri-beri, but, according to statistics collected by the League of Nations, the habit of using highly milled rice is increasing, and in 1937 the inter-governmental committee pointed out that the economic and other factors underlying this tendency had not been fully studied in any country. The Coonoor Laboratories of the Indian Research Fund have now undertaken a comprehensive investigation and issued a report (*Indian Medical Research Memoirs*, No. 32, 1940). Rice is the staple diet in India, and hence the nutritive value of the Indian's food depends mainly on rice. Dr. Aykroyd and his colleagues suggest that agricultural research should aim at the production of high-yielding strains of rice, and that any tendency to abandon parboiled rice in favour of raw should be checked. It is recommended that public health propaganda should include instruction about vitamin losses during the washing and cooking of rice, and that the minimum amount of water be used for cooking and the water drunk, not discarded.

Cod Liver Oil Substitutes

The General Medical Council will shortly publish a second Addendum to the British Pharmacopœia, 1932, in which certain new monographs and certain modifications of existing monographs will be included. Among items of interest to dietitians and others are: Liq. Vitamin A Conc.; Liq. Vitamin D Conc.; Liq. Vitamin A and D Conc.; Ol. Vitamin.

Ol. Vitamin is the war-time substitute for cod liver oil, containing in 1 gram, 1,000 units of vitamin A and 100 units of vitamin D, present in the form of fish liver oil of high vitamin potency as concentrates or, in the case of vitamin D, as calciferol, dissolved in arachis oil. The prophylactic dose is 15 to 30 minims (1,000 to 2,000 units of A and 100 to 200 units of D); the therapeutic dose is three times this quantity.

Five appendices give the determination of ultra-violet absorption in cod liver and halibut liver oils and calciferol; determination of iodine value by the iodine monochloride and pyridine bromide methods, the second of these methods being used for determining the iodine value of the glycerides of halibut liver oil; determination of the unsaponifiable matter in fixed oils and fats; determination of the iodine value of Ol. Amygdal. Vol. Purif.; and the spectrophotometric method for the assay of vitamin A.

Saccharin for Foods

The French Academy of Medicine recently heard a report on the use of saccharin in foods, presented by Professor Lapicque. He recalled that during the last war the Academy had approved the use of saccharin in foodstuffs for the duration of the war. It is not toxic, even in large doses considerably greater than those which might be used, and its only drawback is the fact that it is acid and interferes with the normal action of diastase in the digestion. Professor Fiessinger expressed the opinion that saccharin can provoke digestive troubles, an accusation for which Lapicque insisted he could find no grounds. After M. Portier had noted that saccharin was to be permitted, not obligatory, under the terms of the suggestion, Delpine specified that it must be considered as flavouring, not as a food. The report was then accepted, advising the Ministry of Public Health that the Academy of Medicine is willing, under present circumstances, to accept a regulation authorising the use of saccharin in foodstuffs.

Bacteriology of Wiltshire Bacon

Five years' study of methods of analysis for Wiltshire pickle has shown that the flora is heterogeneous and requires at least two distinct media for its enumeration—*i.e.*, nutrient agar to indicate the degree of contamination and 10 per cent. salt agar to reveal the natural or halophilic flora.

These are the conclusions drawn in a paper by G. B. Landerkin, of the Division of Bacteriology and Dairy Research, Department of Agriculture, Ottawa, Canada.

The rate of colony development and the total number of colonies varied with the salt concentration of the medium. Incubation of plates at 20° C. resulted in greater counts than at 37° or 5° C., and at 20° C. maximum bacteria are

obtained on 10 per cent. salt agar. Bacteria counts on nutrient 5, 10 and 15 per cent. salt agars show a definite relation to each other on over 200 samples taken over five years. The ratio between nutrient and 10 per cent. salt agar counts widened slightly, however, with increased plant sanitation. To obtain maximum counts on salt media, saline solutions were found to be essential, for over 90 per cent. inhibition on 10 per cent. salt agar resulted when physiological or tap-water dilutions were employed. The reduced counts on the salt agar were of the same order as counts obtained on nutrient agar and point to the elimination of a specific group of halophilic bacteria.

Processing Canned Meats

In a paper read at this year's conference of the National Canners Association at Chicago, J. Yeasair and E. J. Cameron reported further processing studies on canned meat products. The original report outlined the various lines of attack. First inoculation tests were made with chosen products, Lunch Tongue, Veal Loaf, and Chili con Carne with beans from several manufacturers to determine the suitability of the test spores P.A. 3679. Heat resistance tests had to be made in substrates of each product and in a basic substrate of a phosphate mixture of *p*H 7·0. Heat penetration data for each product was also necessary. The data obtained from these various tests were to be used in calculating a series of processes for small trial runs of experimental inoculated packs. The paper discusses some results to date.

Among the results of further heat penetration tests carried out last year, it was noted that when Lunch Tongue tubes were incubated directly, higher survival times were obtained with low salt tongue than in high salt tongue. When, however, the heated tubes of the high salt tongue were subcultured in liver broth the survival times were approximately the same as in the low salt tongue, due to the dilution of the salt by subculturing. These results indicate, as in previous laboratory tests, that the high salt was inhibitory for bacterial growth.

Theoretical Dietetics

A rather ironical commentary upon the results of a careful theoretical calculation of a perfect ration from the nutritive standpoint was given in a paper read by Dr. R. A. White, of the Chicago Quartermaster's Depot, U.S.A. Army, at the same conference. Speaking about the experiments conducted with a view of producing an army ration, he says, "We drew up formulas that satisfied every requirement for a perfect ration, formulas which had proper balance, proper calorific value, and that should have produced the acme of palatability. Then we procured the materials and proceeded to demonstrate the accuracy of our calculations. Much to our chagrin many of the beautiful concoctions we put on paper were horrible monstrosities when actually combined in the kitchen. We finally concluded that vitamin sufficiency, perfect balance, bulk and that sort of rot was fine in theory but incompatible in actual practice. We should have to sacrifice something, and finally decided to concentrate upon the factor of palatability. We concluded that if a man could fill his belly with good, wholesome, nutritious, palatable food he would be little concerned about whether that food contained 3,856 calories or 4,273: that he would not suffer from scurvy, beri-beri or zerophthalmia in the few days he was on the ration even if it did not contain sufficient vitamin B complex". Dr. White waxes more sarcastic when he says, "We even concluded that saltpetre was not an essential component of the ration". We may be wrong, but we guess that Dr. White has been annoyed at some time by the dietitians.

Comparison is odious, but we in this country appear to have been able to co-ordinate good dietetics with good belly-filling, judging from the composition and effect of the rations we have tasted.

Machinery and Plant (Control) Order, 1940

Under this order, the acquisition and disposal of machinery and plant of specified classes is prohibited except under licence issued by the Board of Trade.

All persons who propose to acquire machinery or plant of any of the specified classes must therefore first obtain a supply licence from the Industrial Supplies Department (Machinery Licences Division, Board of Trade), and no person may dispose of machinery or plant without first ascertaining that the user has already obtained a licence for the supply from him of that machinery and plant. Machinery and plant for direct delivery to an overseas market or to a Government controlled establishment is, however, exempt from these requirements. There is also an exemption for replacement parts. Applications for licences should be addressed to the department of the Board of Trade aforementioned.

The classes affecting the food industry are: Bakery machinery and plant; bottling and capping machinery (other than for milk bottling and capping); confectionery and sweet-making machinery and plant; machinery for filling and closing containers (other than bottles) for merchandise; packing and wrapping machinery; and sugar-making and refining machinery and plant.

Chemical "Cooking" of Potatoes

The examination of cooked potatoes demonstrates two obvious effects—the starch is gelatinised and, owing to a marked decrease in cell adhesion, the tissue is softened so that it can be readily mashed. If these two alterations are those prerequisite to the conversion of raw tissue into a product having the physical properties associated with cooked potato, it has been suggested by C. J. Personius and P. F. Sharp (writing in *Food Research*, **4**, 469) that it should be possible to obtain the same results by chemical means without the agency of heat. The chemicals used were chloral hydrate, formaldehyde, sodium salicylate or thiocyanate with subsequent treatment with ammonium oxalate. The chemicals effect cold gelatinisation of the starch and the oxalate weakens the intercellular adhesion by removing the calcium from the calcium pectate of the middle lamina, so that the tissue's outward appearance resembles that of cooked potatoes. The texture of potato tissue appears to be the same whether cooking is simulated by chemical means or is accomplished by heat, and that some factor other than the gelatinisation of the starch, and the marked decrease in the cell adhesion of the tissue, must be involved in determining the texture of potatoes, such as sogginess or mealiness.

Dairy Chemistry

A very useful review of the progress of dairy chemistry from the middle of 1937 to the middle of 1939 was published in *the Journal of Dairy Science*, XI., 1, and has been reprinted as Paper No. 576 of the N.I.R.D. The period is characterised by the wide variety of subjects which were extensively and profitably studied. The frequency of occurrence of milk containing less than the presumptive standard of 8·5 per cent. solids-not-fat has been underestimated and this has resulted in greater attention being given to the causes of variation.

Further attention has been paid to the component fatty acid of butterfat by Hilditch and Longenecker, and their theories receive support from Smith and Dastur's work on the effect of inanition on the composition of milk fat.

Oxidised flavour in milk continues to receive much attention, for outbreaks occur when metal contamination and exposure to sunlight are known not to be the cause. Work on the proteins, mineral matter, enzymes, physical chemistry of milk, curd, cheese cream, ice-cream and butter is covered and the wide scope of the review as a whole may be gathered by the 233 references made.

One of the outstanding features of APLIN AND BARRETT, LTD. is strict scientific control at every stage of the operations. Another is the effort made to carry them out under as nearly aseptic conditions as practicable. The illustration shows the first stage in the production of a large range of meat products—the butcher's department, with its white-tiled walls, stainless-steel table and immaculately clean floors.

A MODERN MEAT FACTORY

T. CROSBIE WALSH, F.I.C.

THE company of Aplin and Barrett, Ltd., was founded in 1897, and from small beginnings has grown to a large organisation, manufacturing the wide range of "St. Ivel" products known all over the world.

Housed in a handsome red-brick building of comparatively recent construction, the meat products factory is a model one, in which may be seen every conceivable measure of hygiene employed at each stage in the production of the large range of flesh foods both in the canned and fresh state.

The raw materials entering the factory are immediately placed on a weighing machine beside the bay, and by means of an electric hoist are transferred to a temporary cold chamber. This chamber serves as a deposit for all arriving materials, and the immediate necessities of the factory are supplied from it. For materials which have to be kept longer, other chambers run at a lower temperature are used.

Butcher's and Sausage Departments

In the butcher's department, clean and bright with white-tiled walls, stainless steel tables and immaculately clean floors, whole beef and pork carcases are boned out and trimmed. Pork is separated into lean and fat, and all meat in the boneless state is returned at once to the cooling chambers.

The sausage department is an important one and has a very large daily output. Sausages are not only made for sale in the fresh state but are canned for export.

In common with quite a number of other products, the nature of sausages is governed by regional preferences. In some parts of the country—for instance, London—a fine texture is preferred, while in the West of England they like the meat more coarsely ground. The actual composition is the same in both cases, and the texture, of course, is simply determined by the adjustment of the mincing machines.

The sausage mixture is fed into mechanical sausage filling machines, and the filled casings handled by a large number of girls immaculately attired in white overalls and caps, who link, weigh and pack them. Here is a quiet air of efficiency—no hurry, no "bottle-necks"—each item of the manufacture carried out at such a speed that it just—no more or no less—provides those carrying out the next item with the necessary amount of material. In a word, of course, properly planned work.

Pie Making

A very large department is devoted to pie making, in which is included Pork, Veal, Ham and Egg Pies, Meat Rissoles, Sausage Rolls and Meat Pasties.

For the dough, refined lard is invariably used, and practically all the operations from the mixing of the ingredients to the final product are carried out automatically. The dough is rolled on a safety pastry brake with finely adjustable gear governing the thickness of the pastry.

An interesting machine is the dough divider moulder. The dough is placed in a hopper and by passage through an ingenious cylinder is delivered as floured balls of equal weight, which drop into waiting pie tins. This machine has a weight range of from 1 to 8 ounces and an output of 4,800 pieces per hour.

On an endless belt, the tins now proceed to the pie-forming machine. Here the tin arrives beneath an electrically heated plunger, shaped to the inside of the tin, which descends and presses out the dough to an exact thickness, covering its bottom and sides. Each machine has the capacity of 1,200 tins per hour, and a battery of them is kept busy.

The lidless pies are now filled with meat, and in the case of Veal and Ham Pies the familiar hard-boiled egg is added. Keeping pace with the previous operations is the lidding machine, which, as its name implies, places the top piece of dough and finishes the pie so far as the paste is concerned. Æsthetic additions such as egg yolk for glazing and superimposed floral decorations (made of paste) follow. Very deft are the hands which form the "leaves" and "roses" which adorn the pies. The roses are made by loosely rolling very thin pieces of dough and by pressing down one end of the tiny roll to make petals. The leaves are made by pressing thin dough upon a wooden mould and cutting to the leafy shape.

A large selection of sizes is made, ranging from 4 ounces to 14 lbs. Oblong 6-lb. pies are made specially to be sold in slices by weight.

Cooking and Cooling

Cooking is effected in double-decker coke-fired ovens. Each oven has a capacity of eight hundred pies per hour, the average temperature of cooking being 400° F.

Meat pies, especially the larger sizes, require a long time to cool, and if this is left to take place without any cooling devices, there is a considerable opportunity for moulds and bacteria to get to work while the pie remains at a favourable temperature for their growth.

Such micro-organisms do not get much of a chance in this department. Emerging from the ovens, the pies immediately enter a tunnel provided with a slow-moving belt and through which blows a strong current of filtered, refrigerated air. This tunnel runs from the oven room (which incidentally is air-conditioned) to a closed, filtered, air-cooled room in which exist as aseptic conditions as are

The filled sausage casings are delivered at the far end of the table and all subsequent operations, to the final packing of the weighed sausages, are shown. In the background is seen the high-capacity sausage-filling machine.
Here is a quiet air of efficiency—no hurry, no "bottle-necks"—each item of preparation carried out in a properly planned way, as will be seen by the picture.

The manufacture of sandwich pastes is carried out on a large scale. After the preliminary mixing has been done, mincing machines handle the ingredients, and a fine paste results. This is seen on the right of the picture. On the left is a battery of colloid mills which reduces the paste to a final product of perfect smoothness and butter-like consistency.

Collected in stainless steel receptacles, the paste is taken to the filling machines, each having a capacity of 36 glasses per minute. The picture shows a small part of the big paste-filling department.

humanly possible in an industrial works. As the pies emerge from the tunnel in a semi-cooled state, they are placed on a stainless steel table to be supplied with their portion of jelly. On the table is a vessel containing sterile jelly fitted with a tube, at the end of which is a hollow needle, similar to that of a hypodermic syringe, and through this, with surgical precautions, the jelly is introduced by puncturing the top of the pie. To those who might suggest that this sort of thing is carrying things too far, those involved in their adoption confidently point to data, carefully collated, which show that the "life" of the pie has been considerably prolonged since such methods have been used.

But the cooling is not finished yet. Back go the pies through another tunnel, of design similar to the first one. For another 55 minutes the goods slowly crawl along in a blast of refrigerated, sterile air, and emerge—cold—to the packing tables, where they are immediately placed into their respective cartons. These are particularly attractive, with a window of cellophane, through which the appetising morsel may be clearly seen. A little bit of useful selling psychology on the part of the makers.

The finished products are dispatched the same day by road or rail, and are stored in cold lockers until the moment of dispatch.

Sandwich Pastes

The manufacture of Sandwich Pastes is carried out on an extremely large scale.

Special care is taken to ensure cleanliness of the glass containers. They are unpacked outside the main building to avoid entry of any foreign matter.

Three machines, each having a capacity of 4,500 containers per hour, clean and dry the glasses used for sandwich pastes. The clean glasses are conveyed in baskets to the filling machines by means of an endless belt.

A "close-up" of one of a battery of giant mincing machines.

The raw materials are brought from cold storage to the preparing room. All fish and meats are carefully scrutinised by a staff of skilled examiners, whose capacity for assessing the quality of these materials is quite uncanny.

Some special devices are employed in the preliminary treatment of some of the materials. For instance, a rocking cradle fixed underneath a water spray cleans anchovies in the least possible time.

Mixing the Pastes

After the preliminary mixing has been done, huge mincing machines handle the ingredients and a fine paste results. But a further step is taken. The paste is fed into colloid mills, of which there is a large battery, handling the different sorts of paste. In these mills the paste is reduced, by forcing through apertures twenty-four-thousands of an inch diameter, to a final product of a perfect smoothness and a butter-like consistency.

Collected in stainless steel receptacles, the paste is taken to the filling machines, each of which has a capacity of 36 glasses per minute. The filled glasses, travelling along a belt, are passed to succeeding girls, who level off the paste, wipe the rims and insert the parchment circles, place on the rings and caps and seam on the caps.

The sealed pots in wire baskets are conducted by conveyor to the retort room. In this room is installed a battery of retorts, fitted with instruments for full thermostatic control. An outstanding feature is the close attention given to the removal of steam from the retort room. From each retort, samples are taken from six different points and sent to the laboratory for bacteriological examination.

From the retorts the glasses travel to the labelling machines, and are then packed in cartons. The cartons used are of a special type, which are practically assembled at the same time as they are being filled.

In the stockroom, at the time of my visit, there were 7,000 gross of sandwich paste. As the goods were entering from the factory, a steady stream was emerging, both for home consumption and export. Waiting to be taken away were cases addressed to many parts of the globe, "from China to Peru". Doubtless their contents would carry the message of the British food industry over the seven seas.

Export Section

The export section is an important one and a large selection of preserved goods are shipped overseas. A very attractive pack of tinned Sausages formed one item, while Galantines, Tongues, and Meat Puddings were among others.

The time for preparing Christmas puddings for export is approaching, and the pertinacious Britisher may count on eating the national Christmas fare in spite of the fact that he will, in some cases, do it with the sun blazing outside and the thermometer well above the 100 degrees mark.

Special Lines

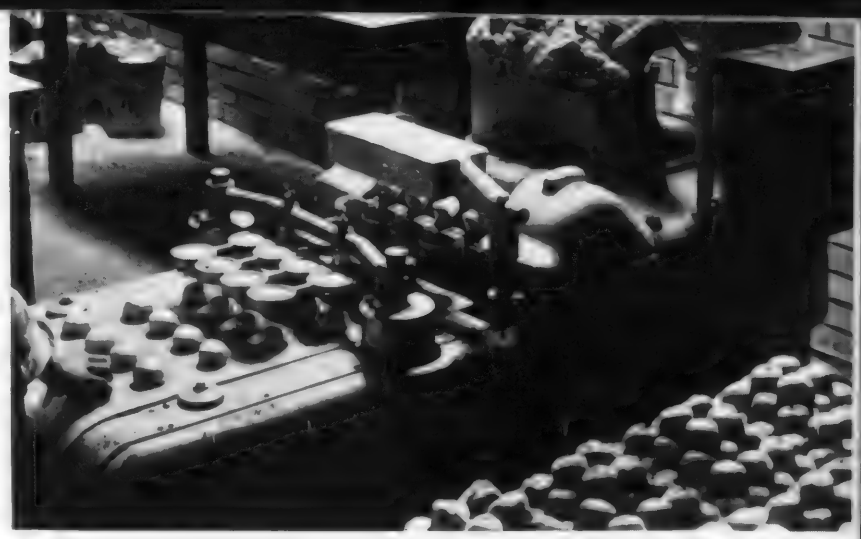
As one proceeds round the factory one is struck with the cleverness of certain little devices which make for efficiency and ease of working. I have already described the jelly-filling apparatus. What has turned out to be a very popular line, only recently introduced by the company, is ready-made Mint Sauce contained in bottles. As one might have expected, the shredded mint is added to the bottles and weighed by an apparatus *ad hoc* and the vinegar is neatly added by another one.

A separate department is concerned with the preparation of Brawns, Pressed Beef and Tongues, in tins and glasses, and a large production is carried out here under the most modern conditions.

The Power House

Steam for the factory is raised by two Lancashire boilers at 160 lbs., reducing as required. Automatic stokers are employed, and Weir pump feed. All feed water is treated by a softener, and a recent introduction of continuous blow-down has proved very successful.

(*Continued on page* 180)



An interesting machine is the dough divider moulder. The dough is placed in a hopper and by passage through an ingenious cylinder is delivered as floured balls of equal weight. This machine has a weight range of from 1 to 8 ounces and an output of 4,800 pieces per hour.

Brawns, Pressed Beef and Tongues, Galantines, in tins and glasses, are made in a separate department. Tinned sausages are packed for home and export trade.

The filled glasses of sandwich paste are passed to succeeding girls, who level off the paste, wipe the rims and insert the parchment circles, place on the rings and caps and seam on the caps.

Pies not happening to be despatched immediately are deposited in the cold lockers. This is the final stage of series of manipulations designed to protect these articles from bacterial contamination and growth.

SAUSAGE WAR FARE

FRANK GERRARD, author of *Sausage and Small Goods Production*, discusses the new problems which the manufacturer has to face due to new regulations and conditions

THE difficulty of obtaining supplies of meat and the Ministries' standards for sausages have presented a number of new problems to the sausage manufacturer. One definition under the Sausages (Maximum) Prices Order is of particular interest to the producer in view of the existing prices for pork. This order defines "Pork Sausages", and under this heading is included "sausages, the meat in which is not pork alone".

Meat—A Variable Constituent

Meat, always a somewhat variable constituent of sausage, now produces wider variations, owing to the nature of the available supplies. The inclusion of offal will give a different water content, and though such a matter might be corrected by an expert machineman, under mass production conditions, such adjustments are difficult to control. Therefore it is essential to standardise the other ingredients and to follow rigidly the method of production, if a reasonably consistent article is to be produced.

The general nature of the meat at present available to the public and the fact that sausages are not rationed will tend to react in favour of the sausage manufacturer, and it should be possible to prepare a satisfactory sausage and still show a reasonable profit.

General Control

With the advent of warmer weather, the question of appearance and commercial life is of paramount importance. In this respect temperature control is a vital factor. With the atmospheric temperature in the region of 40-45° F. the question of putrefactive damage may not be acute, but with temperatures above 50° F., plus the heat generated during manufacture, the rate of bacterial multiplication is considerably accelerated. Researches carried out at Cambridge show that meat stored at 39-40° F. produced sufficient organisms to form slime, not only visible but with an offensive odour in 4 to 5 days, while storage at 68° F. produced these conditions within 24 hours.

Under practical conditions a temperature rise of 10° F. might easily be encountered, and assuming a specific heat of 0·8, the quantity of heat generated in a 100-lb. chopping is considerable. The obvious solution is to precool the meat; to handle it as little as possible; to maintain the knives and plates of the mincer in good condition; and to rapidly cool after filling.

A brisk circulation of air at a low temperature will remove surface moisture and extract the heat. Under extreme temperature conditions solid CO_2 has been employed, and as it absorbs 275 B.Th.U. per lb. in passing from a solid to a vapour, its cooling effect is practically twice that of ice. As solid CO_2 does not form a liquid it can be chopped in with the meat without upsetting the consistency, and the vapour driven off tends to act as a preservative.

Causes of Spoilage

Spoilage can be caused by surface mould, though this condition is more common in cooked than fresh sausage. Putrefactive changes on the sausage and in the substance may be met with, whilst souring may be caused by the binder. Rancidity is generally caused by oxidation of the fat and air pockets due to faulty filling. Exposure to sunlight will accelerate this breaking down. It is claimed that some constituent of soya flour retards oxygen absorption in fats, thus delaying the onset of rancidity.

All plant and equipment should be kept scrupulously clean, and in this respect the thrust washer of the mincer, knives and plates, and the comb of the bowl chopper, should receive special attention. As far as possible wood should be eliminated from the production room, as it is impossible effectively to sterilise it, and it can give rise to continual trouble. Wooden containers for the reception of trimmings, bones, etc., frequently give rise to contamination, and the wooden handles of saws, choppers and knives are frequently neglected. Undoubtedly the ideal material for utensils, and tables or table tops, is stainless steel, but under any circumstances impervious materials should be used.

Cleansing Precautions

Probably the best all-round cleansing agent is sodium hypochlorite, 0·4 per cent. being effective for floors, walls, etc., either by spraying or swabbing. Metallic implements can be submitted to this disinfectant for about 5 minutes, followed by rinsing in clean hot water to avoid corrosion. Periodical spraying of the cold stores after defrosting and cleaning is a good plan. As sodium hypochlorite is absorbed and decomposed by organic matter, thorough scouring is necessary prior to its application. A high percentage of the troubles arising from chopped meat products can be traced to a weak link in the hygienic chain.

Control Recipes

It is questionable if a beef sausage containing not less than 70 per cent. of meat will find a very large market, and, irrespective of price, it is doubtful if the average consumer would appreciate such a product.

Grade A Pork Sausage

Below is a recipe which will form a useful basis for a mildly-seasoned pork sausage to fall into "Grade A".

Pork Sausage.	*Per cent.*	Seasoning.	*Parts.*
Lean meat ...	48	Salt	16
Fat	24	Grd. w. pepper ...	4
Binder	26	Grd. mace ...	2
Seasoning (about)	2	Grd. ginger ...	2
		Grd. sage	1

It will be noticed that a slight margin of safety is allowed, and as the standard has been set for sausages and sausage meat at the same figure, the question of sausage skins appears to have been overlooked.

Meat should be prepared, all skins and gristle removed. Break down the lean meat on mincer, break down fat, put the can meat in bowl chopper followed by seasonings, soaked binder and finally, fat. Chop fairly finely, fill into casings and link as desired. Cool off before delivery. The type of binder employed with such a high meat content is largely a matter of personal preference.

Grade B Beef Sausage

Beef Sausage.	*Per cent.*	Seasoning.	*Parts.*
Lean meat ...	40	Salt	18
Fat	15	Grd. w. pepper ...	5
Binder	43	Grd. nutmeg ...	2
Seasoning (about)	2	Grd. ginger ...	1

(*Continued on page 180*)

LIST OF EXPORTERS
OF
MEAT PRODUCTS PLANT AND MACHINERY

Abattoir Plant, etc.

Brook and Crowther, Ltd., Albion Works, Huddersfield.
Lockerbie and Wilkinson (Tipton), Ltd., Alexandra Works, Tipton, Staffs.
Wm. Douglas and Sons, Ltd., Douglas Wharf, Putney, S.W. 15.
Industrial Waste Eliminators, Ltd., 20, High Holborn, W.C. 1.

Boilers

Robey and Co., Ltd., Globe Works, Lincoln.
Cochran and Co. (Annan), Ltd., Annan, Scotland.
Danks of Netherton, Ltd., Netherton, Dudley, Worcs.
J. Fraser and Son, Ltd., Millwall Boiler Works, E. 3.
John Thompson (Dudley), Ltd., Dudley.

Cans

Metal Box Co., Ltd., Queen's House, Kingsway, W.C. 2.
J. Feaver, Ltd., 120, Tower Bridge Road, S.E. 1.

Can Fillers (Soups, etc.)

Food Machinery (M. and P.), Ltd., Park Works, Manchester, 10.
R. Kellie and Son, Ltd., Dundee Foundry, Dundee.
Albro Fillers and Engineering Co., Ltd., Northampton Works, Watson's Road, N. 22.
Roberts Patent Filling Machine Co., Ltd., Bolton.
Robert Morton and Co., Ltd., Trent Works, Burton-on-Trent.

Can and Glass Washing Plant

Dawson Bros., Ltd., Ventnor Works, Gomersal, near Leeds.
R. Powley and Sons, Ltd., St. Marks Road, Sunderland.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.

Capping Machinery

Wallis Tin Stamping Co., Ltd., 91, Regent Street, W. 1.
Metal Box Co., Ltd., Queen's House, Kingsway, W.C. 2.
Sutax, Ltd., 10, Charterhouse Street, E.C. 1.

Centrifuges

T. Broadbent and Sons, Ltd., Central Ironworks, Huddersfield.
Alfa Laval Co., Ltd., Great West Road, Brentford, Middlesex.
Watson, Laidlaw and Co., Ltd., 98, Laidlaw Street, Glasgow, C. 5.
Manlove, Alliott and Co., Ltd., Nottingham.

Control Instruments

Cambridge Instrument Co., Ltd., 13, Grosvenor Place, S.W. 1.
Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E. 13.
Short and Mason, Ltd., Aneroid Works, Walthamstow, E. 17.
Negretti and Zambra, 38, Holborn Viaduct, E.C. 1.

Conveyor Equipment

Wm. Gardner and Son (Gloucester), Ltd., Bristol Road, Gloucester.
Whitmee Engineering Co., Ltd., Weir Road, London, S.W. 12.
Rownson, Drew and Clydesdale, Ltd., 225, Upper Thames Street, E.C. 4.
Metal Box Co., Ltd., Queen's House, Kingsway, W.C. 2.
H. Morris, Ltd., Loughborough.
Evertaut, Ltd., Walsall Road, Perry Bar, Birmingham, 22.
Farrow and Jackson, Ltd., 16 and 54, Great Tower Street, E.C. 3.
G.C. Engineering Co., Ltd., Grinstead Road, Deptford, S.E. 8.

Cold Storage Plant

J. and E. Hall, Ltd., Dartford, Kent.
Ernest West and Benyon, Ltd., 82, Belvedere Road, S.E. 1.
Lightfoot Refrigeration Co., Ltd., Abbeydale Road, Wembley, Middlesex.
U.D. Engineering Co., Ltd., Abbey Works, Park Royal, N.W. 10.

Cold Storage Plant (*continued*)

L. Sterne and Co., Ltd., 153, Queen Victoria Street, E.C. 4.
York Shipley, Ltd., North Circular Road, N.W. 2.
Pulsometer Engineering Co., Ltd., Nine Elms Ironworks, Reading, Berks.

Dicing Machines

R. Kellie and Son, Ltd., Dundee Foundry, Dundee.
J. C. Wetter and Co., 23, Middle Street, West Smithfield, E.C. 1.

Double Seamers

Metal Box Co., Ltd., Queen's House, Kingsway, W.C. 2.
F. J. Edwards, Ltd., 359-361, Euston Road, N.W. 1.
J. Feaver, Ltd., 120, Tower Bridge Road, S.E. 1.
E. W. Bliss Co., 22, Pocock Street, S.E. 1.

Drying Plant for Blood, etc.

Geo. Scott and Son (London), Ltd., Artillery House, Artillery Row, S.W. 1.
R. Kellie and Son, Ltd., Dundee Foundry, Dundee.
T. Broadbent and Sons, Ltd., Central Ironworks, Huddersfield.
W. J. Fraser and Co., Ltd., Dagenham, Essex.
Kestner Evaporator and Engineering Co., Ltd., 5, Grosvenor Gardens, S.W. 1.
John Thompson (Dudley), Ltd., Dudley.
Watson, Laidlaw and Co., Ltd., 98, Laidlaw Street, Glasgow, C. 5.
Alfa Laval Co., Ltd., Great West Road, Brentford, Middlesex.

Fat Rendering Plant

W. J. Fraser and Co., Ltd., Dagenham, Essex.
George Scott and Son (London), Ltd., Artillery House, Artillery Row, S.W. 1.
John Thompson (Dudley), Ltd., Dudley.
Industrial Waste Eliminators, Ltd., 20, High Holborn, W.C. 1.

Filter Presses

S. H. Johnson and Co., Ltd., Carpenters Road, E. 15.

Glass Jars

Canning Town Glass Works, Ltd., 30-34, New Bridge Street, E.C. 4.
Lax and Shaw, Ltd., Albert Glass Works, Hunslet, Leeds, 10.
National Glass Works (York), Ltd., First Avenue House, High Holborn, W.C. 1.
United Glass Bottle Manufacturers, Ltd., 8, Leicester Street, W.C. 2.
J. W. Sutcliffe and Co., 10-14, Charterhouse Street, E.C. 1.

Homogenisers

Alfa Laval Co., Ltd., Great West Road, Brentford, Middlesex.
G. C. Hurrell and Co., Ltd., 655, Woolwich Road, Charlton, S.E. 7.
Premier Colloid Mills, Ltd., Prince Regent's Wharf, Silvertown, E. 16.
Improved Emulsification Process Co., Ltd., Loughborough.
Peter Brotherhood, Ltd., Peterborough.
Wm. Gardner and Sons (Gloucester), Ltd., Bristol Road, Gloucester.

Labelling Machines

Purdy Patent Machinery Co., Ltd., Euston Buildings, Gower Street, N.W. 1.
Beth Label and Wrapper Machines, Ltd., Dagmar Road, N. 4.

Mincing Machines

Macnaughton and Watson, Ltd., 423, Gallowgate, Glasgow, S.E.
Lancashire Dynamo and Crypto, Ltd., Acton Lane, Willesden, N.W. 10.
Hobart Manufacturing Co., Ltd., Bounds Green Road, N. 11.

Paste Filling Machines

J. G. Jackson and Crockatt, Ltd., Simplex Works, Darnley Street, Glasgow.
Alite Patent Machine Co., Ltd., 12, Holloway Road, N. 7.
Albro Fillers and Engineering Co., Ltd., Northampton Works, Watson's Road, Wood Green, N. 22.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.
Macnaughton and Watson, Ltd., 423, Gallowgate, Glasgow, S.E.

Paste Mixing Machinery

Morton Machine Co., Wishaw, Scotland.
Wm. Gardner and Sons (Gloucester), Ltd., Bristol Road, Gloucester.
Alite Patent Machine Co., Ltd., 12, Holloway Road, N. 7.
J. Booth and Son, Ltd., Congleton, Cheshire.
W. S. Barron and Son, Ltd., Gloucester.
Wm. Brierley, Collier and Hartley, Ltd., Boro' Works, Bridgefield Street, Rochdale.
S. Briggs and Co., Ltd., Copper and Engineering Works, Burton-on-Trent.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.
Kestner Evaporator and Engineering Co., Ltd., 5, Grosvenor Gardens, S.W. 1.
Macnaughton and Watson, Ltd., 423, Gallowgate, Glasgow, S.E.
Pascall Engineering Co., Ltd., 156, Charing Cross Road, W.C. 2.
Geo. Porteous and Sons (Leeds), Ltd., Leeds Bridge Works, Hunslet, Leeds.
Whitmee Engineering Co., Ltd., Weir Road, London, S.W. 12.

Retorts

G.C. Engineering Co., Ltd., Grinstead Road, Deptford, S.E. 8.
Fraser and Fraser, Ltd., Bromley-by-Bow, E. 3.
J. Fraser and Son, Ltd., Millwall Boiler Works, Millwall, E. 14.
W. J. Fraser and Co., Ltd., Dagenham, Essex.
R. Kellie and Son, Ltd., Dundee Foundry, Dundee.
John Thompson (Dudley), Ltd., Dudley.
Food Machinery (M. and P.), Ltd., Park Works, Manchester, 10.

Sausage Filling Machines

Macnaughton and Watson, Ltd., 423, Gallowgate, Glasgow, S.E.
J. C. Wetter and Co., Ltd., 23, Middle Street, West Smithfield, E.C. 1.
H. J. H. King and Co., Ltd., Nailsworth, Glos.

Steam-Jacketed Pans

Aluminium Plant and Vessel Co., Ltd., Point Pleasant, Wandsworth, S.W. 18.
Fredk. Braby and Co., Ltd., Ashton Gate, Bristol.
Wm. Brierley, Collier and Hartley, Ltd., Boro' Works, Bridgefield Street, Rochdale.
S. Briggs and Co., Ltd., Burton-on-Trent.
W. P. Butterfield, Ltd., Shipley, Yorks.
John Dore and Co., Ltd., 21-29, High Street, Bromley-by-Bow, E. 3.
J. Fraser and Son, Ltd., Millwall Boiler Works, Millwall, E. 14.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.
John Thompson (Dudley), Ltd., Windmill Engineering Works, Dudley.

Tanks

Aluminium Plant and Vessel Co., Ltd., Point Pleasant, S.W. 18.
Henry Balfour and Co., Ltd., Artillery House, Artillery Row, S.W. 1.
Fredk. Braby and Co., Ltd., Ashton Gate, Bristol.
S. Briggs and Co., Ltd., Copper and Engineering Works, Burton-on-Trent.
W. P. Butterfield, Ltd., Shipley, Yorks.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.
J. H. Randall and Son, Ltd., Paddington Green Works, North Wharf Road, W. 2.
John Thompson (Dudley), Ltd., Windmill Engineering Works, Dudley.
Carty and Son, Ltd., Harders Road, Peckham, S.E. 15.
W. J. Fraser and Co., Ltd., Dagenham, Essex.
Enamelled Metal Products (1933), Ltd., Artillery House, Artillery Row, S.W. 1.
Thompson Bros. (Bilston), Ltd., Bradley Engineering Works, Bilston.

Trolleys

F. J. Ballard and Co., Ltd., Tividale, Tipton, Staffs.
Fredk. Braby and Co., Ltd., Ashton Gate, Bristol.

Trolleys (*continued*)

Aluminium Plant and Vessel Co., Ltd., Point Pleasant, Wandsworth, S.W. 18.
Robert Kellie and Son, Ltd., Dundee Foundry, Dundee.
J. H. Randall and Son, Ltd., Paddington Green Works, North Wharf Road, W. 2.
W. P. Butterfield, Ltd., Shipley, Yorks.

Vacuum Evaporators

W. J. Fraser and Co., Ltd., Dagenham, Essex.
Kestner Evaporator and Engineering Co., Ltd., 5, Grosvenor Gardens, S.W. 1.
Geo. Scott and Son (London), Ltd., Artillery House, Artillery Row, S.W. 1.
Bennett, Sons and Shears, Ltd., 9-13, George Street, Manchester Square, W. 1.
Robert Morton and Co., Ltd., Trent Works, Burton-on-Trent.
John Thompson (Dudley), Ltd., Windmill Engineering Works, Dudley.
S. Briggs and Co., Ltd., Burton-on-Trent.

Vacuum Seamers

Premier Filterpress Co., Ltd., Grosvenor Chambers, Grosvenor Road, Wallington, Surrey.
John Fraser and Son, Ltd., Millwall Boiler Works, Milwall, E. 14.

Correspondence

SACCHARATE OF LIME

The Editor.

DEAR SIR,

With reference to the second part of the letter by S. Walter Butterworth, in the May issue of your Journal, in regard to Saccharate of Lime, he has committed a common error.

The method of preparation he gives produces Saccharated Solution of Lime, not Saccharate of Lime, which is properly Calcium Monosaccharate. This is the calcium salt of the dicarboxylic acid produced by the oxidation of glucose. Saccharated Solution of Lime is, of course, merely a strong solution of lime in sugar solution.

Zucker-Kalk is in translation merely "sugar lime". I am unaware of the use of this except as an antacid for dyspepsia and as an antidote to phenol poisoning. If it has any use beyond these, perhaps your original enquirer might indicate the properties required, when no doubt British manufacturers would be able to offer suitable substitutes.

It is extremely improbable that Calcium Saccharate will be manufactured in Britain at this time, since the usual process gives about a 20 per cent. yield and is therefore extremely wasteful of glucose.

Possibly, however, it may be produced by some other process of which I am unaware.

Yours faithfully,

G. LAWSON, PH.C., A.I.C.,
Chief Chemist, CUMMING, PARSONS, LTD.

The Editor.

DEAR SIR,

I note that your correspondent differs from Leach and Winton on a question of nomenclature. I also note his helpful translation from the German and his comments thereon.

I agree that it would be most useful if the original enquirer indicated the properties he requires; should these properties concern the thickening of dairy or similar creams, then, no doubt, the information abstracted from Leach and Winton will interest him.

Yours faithfully,
S. WALTER BUTTERWORTH.

EXPORT GROUPS

A List of Export Groups of Interest to the Food Industry

Industry.	Chairman.	Secretary.	Address.
Bakers' Sundries Export Group	Mr. J. Valentine Backes	(Not yet appointed)	Dundee House, 15, Eastcheap, London, E.C. 3.
Bakery and Biscuit Plant Export Group	Mr. L. H. King	Mr. M. C. Cole	c/o Cole, Dickin and Hill, 18, Essex Street, Strand, London, W.C. 2.
Cake and Biscuit Manufacturers' Export Group	The Hon. Cecil N. Palmer	Mr. S. G. Bailey	8, Hanover Square, London, W. 1.
Canning and Food Preserving Machinery Export Group	Mr. Rowland Arnison	Mr. Charles D. Snell	Canning Food Industires Association, Denford House, Norman Way, Southgate, London, N. 14.
Chocolate and Sugar Confectionery Export Group	Mr. F. H. Plaistowe	Mr. W. A. Williams	The British Chemical Plant Manufacturers Association, 166, Piccadilly, London, W.1.
Closure Export Group	Mr. E. A. Blanch	Mr. A. Hodson	53, Park Farm Road, Bickley, Kent.
Dairy Equipment Export Group	Mr. E. A. Shepheard	Dr. Cronshaw	102-105, Shoe Lane, Fleet Street, London, E.C. 4.
Dried Salted Fish Curers' Export Group	Mr. G. Cawood	Mr. J. L. Fraser	47, Naylor Street, Liverpool.
Edible Oil Export Group	(Not yet appointed)	Mr. H. L. Macilwaine	Unilever House, Blackfriars, London, E.C.4.
Essence Trade Export Group	Mr. J. M. Bush	Mr. H. W. Pillow	181, Queen Victoria Street, London, E.C. 4.
Filling Machinery Manufacturers Export Group	Mr. A. G. Cox	National Union of Manufacturers	6, Holborn Viaduct, London, E.C. 1.
Filtration and Silencing Export Group	Mr. C. G. Vokes	Messrs. Peat, Marwick, Mitchell and Co.	York Mansion, 94, Petty France, London, S.W. 1.
Food Manufacturers Export Group	Lt.-Col. G. R. Harding	Mr. A. Stevens	22, Buckingham Gate, London, S.W. 1.
Food Preparation Machinery (Miscellaneous) Export Group	Mr. F. C. Gardner	Mr. W. Leonard Hill	17, Stratford Place, London, W. 1.
Grain Machinery Export Group	Mr. J. W. Muirhead	Mr. J. J. Butler	F.B.I., Midland Bank Buildings, Spring Gardens, Manchester, 2.
Machine Knife and Allied Trades Export Group	Mr. H. T. Wordsworth	Mr. Cyril Bray	Norris Deakin Building, King Street, Sheffield, 1.
Margarine and Compound Cooking Fat Manufacturers Export Group	Mr. T. Thornley	Mr. H. Talbot	21, Lime Street, London, E.C. 3.
Refrigerating Machinery Export Group	Mr. D. A. Bremner	Major E. L. Paske	32, Victoria Street, London, S.W. 1.
Silo Machinery Export Group	Mr. B. D. Milne	Mr. F. R. Jolley	c/o Henry Simon, Ltd., Cheadle Heath, Stockport.
Sugar Machinery Export Group	Mr. D. Sharpe	Messrs. Mann, Judd, Gordon and Co.	142, St. Vincent Street, Glasgow.
Water Purification Plant Export Group	Mr. Wm. Paterson	Messrs. Peat, Marwick, Mitchell and Co.	94-98, Petty France, London, S.W. 1.
Weighing Machine and Testing Machine Manufacturers Export Group	Major C. R. Dibben	Miss J. T. Mountford, B.A.	5, Bennetts Hill, Birmingham, 2.

FOOD CONTAMINATION BY POISON GAS

THE responsibility for protecting the public against dangers arising from contamination of foodstuffs by poison gas rests solely with the local authorities, which, of course, include the Port Health Authorities. It is clear, therefore, that the Medical Officer of Health of the authority will be in administrative control of, and primarily responsible for dealing with, problems which may arise in this direction.

When this matter was under consideration by the Ministry of Food, it was felt that the duties of the Medical Officer of Health have been so much increased since the outbreak of war that it would probably be impossible for him to give personal attention to the immediate task of dealing with contaminated foods. It was decided, therefore, to ask the local authorities to appoint an officer or officers who should be charged with the duty of inspecting such foodstuffs and of supervising any treatment which might be necessary either to render them fit for consumption or to destroy them. It was indicated to the local authorities that the Food Inspector or the Sanitary Inspector would be a suitable person to be charged with these duties, and, following this lead from the Ministry, a large proportion of the authorities have nominated these officers.

Very careful consideration has been given to the question of the most suitable training for these officers. After consultation with the Ministry of Home Security it was decided they would get sufficient general information by attending the full anti-gas course such as is taken by A.R.P. personnel. The local authorities are being notified of this, although it is understood that a considerable proportion of the officers who have been appointed have already received anti-gas training. Guidance in appropriate methods for dealing with contaminated foods will be made available to these officers in the Ministry of Food booklet, "Food and Its Protection against Poison Gas," which will be published by H.M. Stationery Office shortly, and in a memorandum which will be sent to all local authorities. In addition, lectures are given by a member of the Ministry's staff to groups of appointed officers. Local authorities are being notified how the necessary protective equipment can be obtained for these officers.

In the event of an attack in which foodstuffs are affected or are likely to be affected by poison gas, the officer will be expected to proceed to the scene of the raid and to take such action as he deems necessary. Under the Emergency Defence Regulations he has power to seize any contaminated foodstuffs and to order their removal should it appear desirable to take them away either for decontamination or for destruction. It must be emphasised that he will be acting for the local authority, and will be charged, therefore, with the responsibility for taking action. The responsibility cannot be assumed by an unauthorised person.

The officer will be expected to consult with the Public Analyst of the local authority or with any other qualified chemists who may be approved by the authority regarding the subsequent handling of the contaminated material and the taking of such samples as may be required for examination and analysis.

The problem of examining contaminated foodstuffs does not appear to be as complex as is often imagined. In so far as it can be foreseen, chemical analyses will seldom be required except in cases of arsenical contamination or of damage from mustard gas. The former presents no special difficulties to an analytical or food chemist, whilst the latter is covered by the memorandum referred to above.

Careful consideration of likely contamination with either types of war gases likely to be encountered in attacks on open towns leads to the conclusion that the effects will either be negligible or such that the foodstuffs are rendered so unpalatable that their use as food will be out of the question. Non-persistent gases of the phosgene type affect foods so slightly in the concentrations likely to be encountered that there does not appear to be any special chemical problem to face. Treatment of such foodstuffs would consist in nothing more elaborate than adequate airing, and it does not appear likely that any special chemical work will be called for. On the other hand, some of the persistent gases, such as bromo-benzyl cyanide, cause serious damage to foodstuffs by rendering them unpalatable. In such cases, also, it does not appear likely that chemical work will be required to any significant extent. Even in traces so minute that the foodstuffs would not be rendered harmful these gases make them quite uneatable; there does not, therefore, appear to be any alternative to destruction.

Book Review

FIGHTING INSECT PESTS

With the onset of hostilities and the altered, indeed revolutionised, conditions associated therewith, the insect pest problem has assumed greater magnitude. What was formerly and far too often considered little more than a nuisance has now been finally recognised as a definite menace. The evacuation problem, the herding together of Military, Naval and Air Force personnel in emergency quarters, the mobilisation of Civil Defence Units, even the necessary alterations in the sanitary staffs of local authorities—all these factors have played and are still playing an important part in bringing the insect pest into the foreground of our national conscience.

It is for these reasons that the authors present their little book, with the hope that it will prove of some definite and practical use to those authorities and individuals who have the responsibility of insect pest control placed in their charge.

The book is almost entirely concerned with those insect pests which infect human beings and their homes, although at the end there is a short chapter on the disinfestation of foodstuffs. However, the concentration of large numbers of employees, especially in the poorer industrial districts, may well be a reason for interest in the matter on the part of the food manufacturer.

After a somewhat cursory introduction the bed-bug is discussed. We learn that half the population of Greater London suffers from bugs to a greater or lesser extent at some time or other during the year, and *not more* (the italics are mine) than 35 per cent. of the houses are affected at any one time.

The authors state that, although often suspect, bed-bugs have not yet been definitely convicted of carrying disease. They go on to say, however, that bed-bugs have experimentally been shown capable of acting as carriers or intermediate hosts of sleeping sickness, infectious jaundice, malaria, relapsing fever and yellow fever. They may also act as mechanical carriers of plague and leprosy. It is difficult to reconcile these two statements and references to the bibliography would have been useful to the interested reader. Incidentally, the book is entirely devoid of bibliographical references. There is no doubt that a good bibliography considerably enhances the value of any scientific or technical handbook. Where the authors discuss fumigants for bed-bugs it is a little irritating to read that "Formaldehyde is the standard method adopted by the Army Medical Services, but it is not recommended." It would not have occupied much extra space if the authors had given the reasons for this opinion.

The flea cannot be acquitted from the charge of being a disease carrier, although one disease—plague, or rather three modifications of it—is mentioned. Fortunately that disease has practically been eradicated in this country, although were it not for the precautions taken in the deratisation of ships there might well occur outbreaks, for it is common in many countries. That a wholesome dread of rat fleas is present in the populations of those countries was the present reviewer's experience in a plague-stricken town. He remembers being in a grocer's shop when a rat suddenly appeared and as suddenly died. The shop was cleared of people as quickly as any air-raid warning could have done it, for fleas leave a rat as soon as it dies, or at least that is the belief.

The louse is another dangerous insect and a carrier of serious disease, and instructions on de-lousing the body and fumigating clothing are given. The cockroach, cricket, silver fish, ant, itch mite, book louse, earwig, wood louse and last, but not least, the housefly are all discussed.

The latter part of the book deals with practical matters, such as building construction and infestations; gaseous fumigants and the technique of their use; other specifics; suggestions as to educational measures in fighting pests. The chapter on human toxicology should be useful to those whose work lies in fumigation.

This is a useful handbook for those engaged in what cannot be a very savoury task.

Insect Pests. *Wm. Clunie Harvey, M.D., D.P.H., M.R.San.I., and Harry Hill, M.R.San.I., A.M.I.S.E., M.S.I.A. Pages x+292. 23 illustrations.* 10s. 6d. *net.*

Sausage War Fare

(*Continued from page* 176)

Grade B Pork Sausage

Pork Sausage.	*Per cent.*	Seasoning.	*Parts.*
Lean meat ...	45	Salt	18
Fat	15	Grd. w. pepper ...	6
Binder	38	Grd. nutmeg ...	4
Seasoning (about)	2	Grd. mace ...	2
		Grd. ginger ...	3
		Grd. sage ...	1

Grade C Sausages

When the meat content of sausage drops much below 50 per cent., considerable skill is necessary to produce an attractive "meaty" type of sausage which will stand up to frying without bursting or shrinkage. Therefore, many manufacturers prefer to use boiled rice as a filler. Provided that care is taken in boiling the rice, a satisfactory article can be produced. The rice should absorb about 3½ times its weight of water, and it is desirable to add some colouring matter to the cooking water to offset the dead white colour of the rice. After cooking, the rice can be stored in shallow dishes in a refrigerator until it is required. It is usual to add a small percentage of dry rusk and fairly late in the chopping to take up any free fat.

With this type of sausage it is sometimes advisable to add some additional flavouring substance, such as a yeast extract, to produce a meaty after-taste. Some manufacturers include about 8 per cent. of rendered fat to improve the texture and to cause a meaty odour to emanate from the cooked sausage.

Under existing conditions it is essential that periodical costings should be taken, to check up the yields obtained from the various classes of meat.

Modern Meat Packing

(*Continued from page* 175)

Welfare and A.R.P.

The top floor of the new building is devoted to cloakroom accommodation and a canteen, wherein refreshment is obtainable during morning and afternoon rest periods, and facilities for midday meals are also provided.

The blackout has involved much work in a building constructed with the maximum window space. An efficient air raid shelter has been constructed in the underground basement of this steel and concrete floored building. Most of the staff have been trained in A.R.P. work; some are wardens, and the chief bacteriologist is a certificated Gas Identification Officer. The factory has its own fire brigade, first-aid parties, demolition squads, etc., and frequent practices are held.

LIST OF SUPPLIERS TO APLIN AND BARRETT'S MEAT PRODUCTS FACTORY

Automatic Stokers: *Bennis Combustion Co., Ltd.*
Pastry Brakes: *Baker Perkins, Ltd.*
Dough Mixers: *Artofex Engineering Works Co., Ltd.*
Pie Lidding Machine and Ovens: *J. G. Jackson and Crockatt, Ltd.*
Electric Hoists: *Herbert Morris, Ltd.*
Meat Cutters: *J. C. Wetter and Co.*
Sausage Filling Machines: *H. J. H. King and Co., Ltd.; J. C. [Wetter and Co.*
Paste Mixers: *Premier Colloid Mills, Ltd.*
Bottle-Washing Machines: *G. J. Worssam and Sons, Ltd.; Auto Dairy Engineers, Ltd.*
Detergents for Bottle Washing: *Imperial Chemical Industries, Ltd.*
Paste Filling Machine: *J. G. Jackson and Crockatt, Ltd.*
Retort Indicators and Control; Distance Thermometers for Refrigerators: *Cambridge Instrument Co., Ltd.*
Capping Machines for Paste Jars: *Wallis Tin Stamping Co., Ltd.*
Labelling Machines: *Purdy Patent Machinery Co., Ltd.*
Beam Code Dating Machine: *C. C. Gibson.*
Machine for Adding Liquids for Mint Sauce: *Gaskell and Chambers, Ltd.*
Boxes for Packing Paste Packs: *Brehmer Folding Box Co., Ltd.*

THE BACTERIOLOGICAL EXAMINATION OF CANNED FOODS

Part I

T. E. BASHFORD

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IN THESE articles it is not intended to cover a complete description of the bacteriology of canned foods and all its implications, but rather to present to those connected with the industry and not familiar with this aspect of canning technology a general survey of the tests necessary and the associated factors considered when making bacteriological examinations.*

In the first place, the various groups of micro-organisms will be briefly described together with certain of their characteristics.

Non-Heat-Resistant Organisms

Under this heading are included moulds, yeasts and non-sporing bacteria, as they are all types of organisms which are more or less readily destroyed during the heating process. In general their presence in processed canned foods indicates that the cans were not properly processed or that the organisms had gained access after processing as the result of defective sealing of the containers.

Moulds. The moulds may be broadly defined as multicellular organisms—that is, a number of cells are joined together to make up the individual—composed of filaments or hyphæ and fruiting bodies bearing spores. The groups into which moulds are distributed are principally based on the form of the spore-bearing cells.

The mould of most importance to the canning industry, owing to its relatively high resistance to heat, is *Byssochlamys fulva*. This organism was first described by Olliver and Smith,[6] and valuable contributions to our knowledge of its characteristics have been made by Hirst and McMaster,[7] Olliver and Rendle,[8] Hull,[9] and Gillespy.[10] This mould has been responsible for spoilage in canned and, to a larger extent, in bottled fruits. It attacks the pectinous substances, eventually disintegrating the fruit to a pulpy mass. From the reports by the various investigators it appears that certain forms of the fungus are widely distributed in orchards, and it has been found in straw, bags and other situations, but its actual site of growth has not yet been determined. Hull, discussing the results of his experiments, states that high temperatures are necessary in the centre of the can to overcome heavy artificial infection, and recommends, wherever possible, that conditions of processing should be employed which will kill the most resistant spores, suggesting that temperatures of at least 190° F., and preferably 195° F. in the centre of the can, be aimed at. Fig. 1 illustrates both sound raspberries and those that have been attacked by *B. fulva*.

Yeasts. Yeasts or blastomycetes are round to oval unicellular organisms larger than bacteria, and their chief characteristic is the method of reproduction by budding where a portion of the cell protrudes, increases in size, and then breaks away to form a new individual. Yeasts may be found in spoiled acid products such as fruits and occasionally in other packs where they have gained access as the result of defective containers.

Bacteria. True bacteria are divided into three main classes according to whether the single cells are round, rod-like, or spiral-shaped. Those of interest to canners which are not resistant to heat belong to two groups known as cocci and non-sporing bacilli. Cocci are round or ovoid bodies and bacilli are straight or slightly curved rod-shaped organisms. Cocci are further grouped according to the position of one cell in relation to another; for example, Streptococci, with the individual bodies arranged in chains; Staphylococci, in which they are grouped in clusters; Diplococci, in which the cells tend to be arranged uniformly in pairs. Bacteria in general are classified according to morphology, ability to ferment sugars and similar substances, growth requirements, etc. Typical cocci isolated from spoiled cans are shown in Fig. 2 and non-spore-forming bacilli in Fig. 3.

It should be mentioned that one canned food in particular—namely, sweetened condensed milk—might be expected to be subject to spoilage by non-heat-resistant organisms since it is not processed in the container, but the development of spoilage organisms is checked by the maintenance of a high sugar concentration, by cleanliness of the milk and equipment, and by avoiding the trapping of air when closing the container.

Heat-Resistant Organisms

Aerobic Spore-Forming Bacteria. The bacteria which will develop and multiply when free oxygen is available are known as "aerobes", and to those which only grow in the absence of free oxygen the term "anaerobe" is given. A third division, facultative anaerobes, have the power of growing under both conditions. It should be mentioned that certain of the spore-forming bacilli placed in the aerobic group are not strict aerobes, for while aerobic conditions are the optimum for growth they also have the power of developing, to a varying degree, under conditions of oxygen pressure below that of air.

Spore formation is the development of a highly resistant resting phase by which the individual survives unfavourable external conditions. One spore is formed by each vegetative organism and appears in the cell protoplasm as a round or oval highly refractile body surrounded by a dense membrane. Spores are relatively resistant to chemical and physical agents including heat, a property believed to be due to the enclosing membrane, and under favourable conditions will assume the original bacillary form again. It is this ability to form spores which makes such bacteria of so much importance to the canning industry. Fig. 4 illustrates spore-forming bacteria isolated from spoiled cans.

Bacterial spores must not be confused with the bodies known as spores produced by the moulds and yeasts. These spores are not unduly heat-resistant, although they do represent the resting stage of the individual meeting unfavourable conditions for growth.

Fig. 1.—*Byssochlamys fulva*, illustrating the attack on raspberries by this mould.

* *More comprehensive reports and detailed papers have already been given by Savage,[1] Esty and Stevenson,[2] Tanner,[3] Lancefield,[4] Jones and Jones,[5] and others, and those desiring further information are referred to these works.*

The aerobic spore-forming bacilli are widely distributed in nature and are found in soil, water, dust, air, etc. The spores of these bacteria are resistant to heat, but are not generally considered to be so resistant as some other classes of organisms, to be described later, which originate from similar sources and are therefore often present as accompanying contaminants. The presence of the aerobic spore-formers in canned food is generally taken as an indication of inadequate processing, providing, of course, the container has been effectively sealed.

As far as actual spoilage due to this group of bacteria alone is concerned, it seems that canned unsweetened evaporated milk and canned cream are chiefly affected. Nichols[11] and other workers have reported the findings of these organisms associated with such products showing various changes in consistency and flavour, and it appears that they can exist in the dormant state as they were also obtained from canned milk and cream which were not noticeably defective. Nichols suggests, however, that it is ordinarily possible for evaporated milk and canned cream to be prepared in such a way as to be free from living organisms or their viable spores.

Anaerobic Spore-Forming Bacteria. The reason why anaerobes fail to grow in air is not yet clear, but it has been suggested that they are unable to form the enzyme catalase, which promotes the destruction of the peroxides produced when organisms grow in the presence of free oxygen, and which when they accumulate inhibit bacterial growth. More recent work indicates that anaerobes can only develop at a low oxidation-reduction potential, and the failure to grow when held under aerobic conditions may be due to the inability of these bacteria to create conditions below a critical potential.

Like the aerobic spore-forming bacteria, the anaerobes are widely distributed and are to be found in soil, dust, animal excreta, and associated with decaying organic material. Owing to the high heat-resistance of their spores they are responsible for spoilage in canned foods, particularly in those products containing fish, meat, or vegetables, their occurrence in soil, etc., probably accounting for their presence. It will be appreciated that the condition present in a can—that is, absence of free oxygen—is ideal for the growth of these organisms. Many of the strains have the power of splitting proteins during their metabolic process, giving rise to offensive changes in the attacked material which it has now become customary to refer to as putrefaction, although as Savage[12] points out, the term "putrefaction" covers a complicated series of changes in organic matter of the highest chemical complexity, and bacteria whose breakdown products are not necessarily offensive may be equally spoken of as putrefactive organisms.

The names of the various strains of anaerobes are often to be seen written prefixed by *Clostridium* in place of *Bacillus*. This is the term given to the group of anaerobic spore-forming organisms in the newer nomenclature recommended by the Society of American Bacteriologists, and which is now becoming widely adopted—more, perhaps, as far as this country is concerned, in the industrial than in the medical field. Bergey, Breed, Murry, and Hitchens[13] give the following definition for Clostridia—"Anaerobes or microaerophile, often parasitic, the rods are frequently enlarged at sporulation producing clostridium or plectridium forms"—that is, the single cells resemble morphologically spindles or plectrum-like bodies.

From time to time workers have reported investigations on the heat-resistance of the anaerobic spore-formers, particularly in respect of *Clostridium botulinum*, an organism of which more will be said later. Esty and Meyer[14] found that the heat-resistance of 100 strains of *Cl. botulinum* from various sources, varied from 3 to 80 minutes at 105° C. (221° F.) when heated in a phosphate solution *p*H 7·0 to 7·12, and the heat-resistance of 33 strains of *Cl. sporogenes* varied from 10 to 150 minutes at 100° C. (212° F.); 4 to 45 minutes at 105° C. (221° F.), and 1 to 12 minutes at 110° C. (230° F.). Baumgartner and Wallace,[15] investigating an organism closely related to *Cl. sporogenes*, isolated from air-borne dust containing animal fur, reported that when heated in a cooked meat medium at *p*H 6·0 to 7·0 it survived 15 hours at 100° C. (212° F.); 50 minutes at 110° C. (230° F.); 40 minutes at 115° C. (230° F.); and 15 minutes at 120° C. (248° F.). Cameron[16] used a strain of putrefactive anaerobes, having a resistance of 12 hours at 100° C. (212° F.), for inoculating into caramel products in connection with processing studies.

Botulism

Some of the anaerobes are pathogenic and the organism of particular importance to the canning industry is *Clostridium botulinum*,* which is responsible for the food-poisoning disease, Botulism. This is the most heat-resistant of the food-poisoning bacteria and there have been many valuable investigations carried out to study the bacillus, especially in America. These are reviewed in varying detail by authors of textbooks dealing with bacteriology; Tanner[17] has supplied a comprehensive survey of both the published literature concerning this organism and of many of the food-poisoning outbreaks caused by it.

Botulism has been associated with a number of types of preserved foods such as sausage, hams, canned and glass-packed goods, etc., and, in fact, the term is derived from the Latin, *botulus*, meaning sausage.

The organism is capable of development in most non-acid canned foods, and, although its optimum temperature is 35 to 37° C. (95 to 98° F.), it will grow quite well below this temperature. Infected foods may not necessarily exhibit marked spoilage changes.

The spores of the bacillus are very heat-resistant, and Esty and Meyer[14] found the maximum resistance of spores artificially produced under the most favourable conditions for growth and heated in a phosphate solution at a *p*H 7·0 to be 330 minutes at 100° C. (212° F.); 100 minutes at 105° C. (221° F.); 32 minutes at 110° C. (230° F.); 10 minutes at 115° C. (239° F.); and 4 minutes at 120° C. (248° F.). These, and other workers, have reported the effects of hydrogen-ion concentration (*p*H), salt content, number of spores present, etc., in the destruction of spores by heat, and Topley and Wilson[18] state: "It is probable that a large number of factors determine the survival, germination, multiplication, and toxin production of *Cl. botulinum* in canned food. Unless these factors are favourably combined, the food remains innocuous."

Outbreaks of botulism rarely occur at the present time, a result largely attributable to the work of food bacteriologists and the high standard of process control now practised in most food factories.

(To be continued.)

REFERENCES

1 Savage, W. G. (1923), *Canned Foods in Relation to Health*, and *The Bacteriological Examination of Foods and Water*, Cambridge.

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3 Tanner, F. W. (1932), *The Microbiology of Foods*, Illinois.

4 Lancefield, S. (1934), *Food*, **4**, October and November; (1935), **4**, January-September; (1935), **5**, October and November.

* *A comprehensive article on Botulism by Elliott B. Dewberry was published in* FOOD MANUFACTURE, *April*, 1940.

(Continued on page 188)

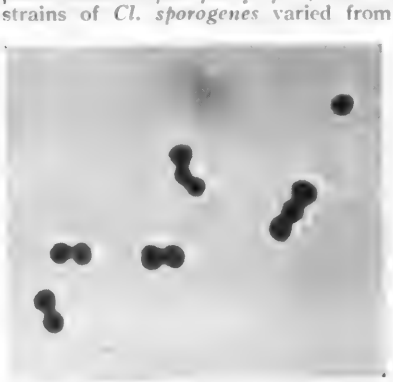

Fig. 2.—Cocci isolated from a can of baked beans which had spoiled as the result of defective seams. (× 4,500.)

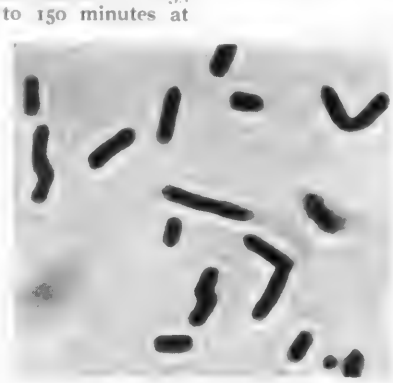

Fig. 3.—Non-spore-forming Bacilli obtained from a leaking can. (× 4,500.)

Fig. 4.—Heat-resistant, spore-forming Bacilli grown in cultures from a can of herrings in tomato sauce. (× 4,500.)

EGG ALBUMEN IN FOOD PRODUCTION

The food industries make extensive use of prepared colloids. Some of these, such as starch, gum arabic and egg albumen, have been employed for many years, while others, among which are pectin and sodium alginate, are of more recent introduction. Among the different colloids, egg albumen still remains of great importance in many branches of the food industry.

D. W. GROVER, B.Sc., A.I.C.

THE raw material from which commercial egg albumen is prepared is the white of eggs, mostly hen eggs. The white has an important natural function in the egg as a support and cushion for the yolk and growing embryo. For this purpose its structure renders it well suited, the differentiation into "thin" and "thick" white being of interest. Winton[1] gives a good account of the structure of an egg.

The commercially important properties of egg albumen, its whipping power and ready coagulation by heat, do not appear to have any relation to the natural function of egg white. Nevertheless, the occurrence together of these properties has given egg albumen a unique place in the production of some foods from which there is no prospect of its being ousted, in spite of the incentive provided by its comparatively high price.

Commercial Aspect

The majority of the egg albumen sold to-day is produced in China, where much of the production has been placed on a sound scientific footing. The industry in China has been described by Cole[2] in this journal in 1933. The production in China is divided into two main classes, "European" and "Native", according to whether the producing factory is under European or native direction. The "European" grade is the higher.

In Table I. are given the imports of egg albumen into Great Britain in 1936, 1937 and 1938, together with the declared value and the value per cwt.

The quantity figure shows a slight decrease over the period. As regards the distribution of the trade, China has an overwhelming preponderance. Imports from U.S.A. show a decided increase, being about 6 per cent. of the total in 1938. The size and growth of the Chinese trade is indicated by the figures for imports into U.S.A. of Chinese albumen.

1900	nil
1926	3,458,000 lb.[2]
1935	2,597,000 ,,
1938	605,000 ,,[11]

It is of interest to note that, as far as trade with Great Britain is concerned, the hostilities in China had little, if any, effect up to June, 1939.

The Composition of Eggs and Egg White

Hen eggs are composed of shell, white and yolk in approximately the following proportions: 10·7 per cent., 60·4 per cent., 28·9 per cent. respectively. The white consists of an almost pure solution of protein. Besides water and about 12 per cent. of protein, only 0·5 per cent. of dextrose, 0·7 per cent. of ash and minute traces of lecithin, fat, etc., are present.[3]

The specific gravity and refractive index of egg white vary according to the water content. Almquist and collaborators[4] give the figures in the table below:

Solids Per Cent.	*Refractive Index.*	*Specific Gravity.*
10·55	1·3520	1·0312
14·55	1·3600	1·0444

The proteins of egg white have been separated by Osborne and Campbell[5] into the following four fractions:

TABLE I.—IMPORTS OF EGG ALBUMEN INTO GREAT BRITAIN.[6]

Country of Origin.	1936. *Quantity, Cwts.*	1936. *Value, £.*	1936. *Value Per Cwt.*	1937. *Quantity, Cwts.*	1937. *Value, £.*	1937. *Value Per Cwt.*	1938. *Quantity, Cwts.*	1938. *Value, £.*	1938. *Value Per Cwt.*
Belgium	48	577	12·0	219	2,653	12·1	468	5,682	12·1
Germany	44	488	11·1	20	238	11·9	70	869	12·4
Italy	—	—	—	4	45	11·3	4	38	9·5
U.S.A.	—	—	—	532	6,030	11·3	1,109	14,693	13·2
Netherlands ...	91	1,095	12·0	62	648	10·5	171	2,136	12·5
China	21,680	242,721	11·2	20,519	215,992	10·5	17,516	216,946	12·4
Hong Kong ...	—	—	—	—	—	—	181	2,010	11·1
France	—	—	—	—	—	—	20	271	13·6
Other countries ...	39	427	10·9	4	31	7·8	—	—	—
Total	21,902	245,408	11·2	21,360	225,637	10·6	19,539	242,645	12·4

NOTE.—The imports from other countries are almost entirely re-exports of Chinese origin.

Ovalbumin:* Crystallisable, coagulated at 60° to 64° C. (2·5 per cent. solution).
Conalbumin: Coagulates at lower temperature.
Ovomucin: Precipitated by dilution.
Ovomucoid: Not precipitated by heat.

Ovalbumin can be prepared in a pure condition by crystallisation followed by dialysis to remove salts. Its properties have been the subject of a considerable amount of research. It is amphoteric[7] (can combine with both acids and bases) and has an isoelectric point of *p*H 4·55.[7] Its specific rotation is from −28·5 to −30·8.[8] Its molecular weight is reviewed by Clayton,[9] who selected a value of 34,000 determined by Svedberg. Svedberg[10] himself, however, in a later publication, quotes values of 40,000 to 44,000 obtained by the ultra-centrifuge. Calvery[12] from a consideration of the amino-acid composition arrives at a value of 36,000. The amino-acid composition of ovalbumin according to two sets of observations is given in Table II. The globulins and mucin of egg white have been investigated by the Food Investigation Board.[13]

TABLE II.—THE AMINO-ACID COMPOSITION OF OVALBUMIN.

	Osborne et al.[14]	*Calvery.*[15]
Glycocoll	0·00	—
Alanine	2·22	—
Valine	2·50	—
Leucine	10·71	—
Serine	?	—
Cystine	0·58	1·33
Aspartic acid	2·20	6·07
Glutamic acid	9·10	13·96
Hydroxy glutamic acid ...	—	1·36
Tyrosine	1·77	3·20
Phenylalinine	5·07	—
Proline	3·56	4·15
Tryptophane	2·25	1·28
Arginine	4·91	5·03
Lysine	3·76	6·41
Hystidine	1·71	2·44
Ammonia	1·34	—
Phosphorus	—	0·10

The Manufacture of Egg Albumen

It is not intended to discuss manufacturing methods here as these have already been described in this journal.[2] Some points arise, however, which throw light on the physical nature of the prepared product, and these will be briefly considered.

Before drying of egg white can be commenced the "thick" white, a more viscous portion constituting 60 to 70 per cent. of the total, must be rendered less viscous. If this is not done, not only is drying made more difficult, but the product has greatly impaired solubility in water.[16]. Thinning of thick white occurs in whole eggs during storage, a fact which Balls and Swenson[17] attribute to the presence of a proteolytic enzyme in the white. Manen and Rimmington,[18] however, fail to find such an enzyme in either thin or thick white. In commercial practice the whites are thinned by a process of fermentation in vats at room temperature for several days. The action in these circumstances is undoubtedly brought about by extraneous micro-organisms and not by enzymes of the egg white. Figures for the bacterial count of fermented egg white after 6 days in the vat (1,800,000 per c.c.)[16] confirm this conclusion. Balls and Swenson[16] found that the fermentation process caused the evolution of carbon dioxide and ammonia. In other cases acid production is reported and neutralisation of the acid during manufacture becomes necessary.[2] Presumably whether acid or ammonia is produced depends on the types of organism predominating in the vat. During fermentation the sugar combined in the mucin, etc., of the egg white is consumed.[16]

* The word albumin is used to denote a class of proteins of which ovalbumin is an example. Albumen, on the other hand, is the name of commercial dried egg white.

Alternative Processes

Alternative processes for the thinning of egg white have been suggested. Balls and Swenson have developed a method dependent on the action of a proteolytic enzyme for which they claim certain advantages. Their patent[19] claims as follows:

A proteolytic enzyme (*e.g.*, trypsin) is mixed with fresh egg white and the mixture maintained at a favourable temperature until the thick portion is thinned to a desired consistency. This process gives greatly accelerated thinning and lower bacterial counts in the thinned product. If a suitable low temperature is maintained, a product of negligible microbial count can be obtained. The sugar combined in the whites is not consumed and a product having properties almost identical with fresh egg white can be prepared. The chief disadvantage, and indeed a very serious one, is the instability of the prepared dried albumen. Storage at room temperature quickly denatures the proteins and causes the albumen to have poor colour and to become insoluble in water. Storage at ice-box temperature retards this deterioration indefinitely. It appears that the enzyme process does not carry the breakdown of the protein complexes sufficiently far.

A second alternative treatment is that of McCharles and Mulvany.[20] They treat the egg whites at a *p*H of about 5·8 at an elevated temperature below the coagulating temperature under vacuum. They then adjust the *p*H to about 7·0 and spray-dry. The product is claimed to have improved keeping and whipping properties.

Harris[34] describes a method for treating egg whites which yields a homogeneous product of good whipping properties. The whites are introduced continuously into a cylindrical vessel where they are subjected to violent shearing action by an impeller and subsequently filtered. This material would not appear to be sufficiently broken down for drying.

The thinned egg white is dried either by spray or roller drying. If roller drying is used the temperature is kept at about 120° F., when the bacterial action is suppressed as much as possible consistently with freedom from coagulation.[2] On the farms in China during the hot season the whites are sun-dried in open zinc trays.[2] The roller-dried albumen is the familiar flake or crystal, produced in various grades and usually packed in 100-lb. tins. The spray-dried powder is more rapidly soluble than the flake and is frequently incorporated in proprietary whipping powders for use by bakers, confectionery manufacturers, etc.

The Grading of Egg Albumen

Several grades of flaked albumen as well as various powdered products are available to the purchaser of egg albumen, and there are certain factors which should be taken into account when buying. Powders are more easy to adulterate than flake and it is not possible to arrive at such a good estimation of quality by visual inspection. Mendelsohn[21] recommends microscopical examination of powdered albumen. True albumen appears as translucent particles bounded by rounded edges. A drop of clove oil obliterates these outlines, leaving adulterants such as dried milk and also coagulated particles

clearly visible in a mainly clear field. Comparison with samples of known purity is recommended.

Colour, smell and bacterial count should be taken into account, the results, of course, being considered in the light of the probable use of the albumen. A dark colour indicates an inferior grade. Smell is judged in several ways. Some of the flake may be warmed by holding in the hand before testing or a solution may be prepared and warmed. An alternative is to plunge a heated iron rod into a solution and withdraw, noting the smell produced. As a measure of freshness the protein decomposition products skatole and indole may be estimated.[2] In view of the use of zinc trays for drying some of the cheaper grades this metal should be suspected.[3] Duck albumen can be distinguished from hen albumen by a serological method.[22]

Several standards have been accepted in the trade for fancy-quality albumen. These standards usually fix limits for insoluble material, smalls and water content. The London Chamber of Commerce put the maximum water content at 17 per cent., while the London Importers had a limit of 14 per cent.[2] Limits fixed by the Board of Assessors for prime European Crystals imported into this country are given in Table III.

TABLE III.—STANDARD FOR "PRIME EUROPEAN CRYSTAL" HEN ALBUMEN.

Moisture	16	per cent.	maximum
Insoluble	5	,,	,,	,,
Smalls (through No. 16 mesh sieve)	20	,,	,,	,,
Acidity as lactic acid	1·2	,,	,,	,,
Colour: light straw				
Crystals: bright and fairly thin				

The Egg Products Association Inc. of the United States have issued in their "Rules and Regulations" standards for "fancy", "prime" and "fair" albumen. Their standard methods of testing include those for whipping power and stability of whip.[23] The whipping power is measured by the height of foam produced under carefully standardised conditions and stability by the amount of drip occurring in 15 min. and 30 min. with a plug removed from the bottom of the beating vessel. In Table IV. are shown typical results obtained with commercial grades of hen albumen.

TABLE IV.—THE WHIPPING POWER AND STABILITY OF EGG ALBUMEN.

Grade of Albumen.	*Whipping Power (Height of Whip).*	*Stability (Drip in 30 min.).*
Fancy Chinese hen	6·0	39
Prime Chinese hen	5·75	50
Ordinary Chinese hen	5·25*	173
Spray dried (U.S.A.)	6·0	71
Low-grade Chinese	3·0	250

* Whip sloppy.

These figures confirm the generally held opinion that Chinese albumen is superior to the produce of other countries.

The Physical Properties of Egg Albumen

The physical properties of egg albumen of importance to users in the food industries are its whipping power (and stability of whip) and its coagulation at moderate temperatures. Both of these properties have been the subject of a considerable amount of investigation.

Whipping Power and Stability

The whipping power and stability of whip are usually considered together, as is indicated by the standard test already referred to. Bailey[24] found that *freezing* had no harmful effect on the whipping power of egg white and that thick white is superior to thin white in this respect. Whipping power and stability are affected by *p*H. Bailey[24] found that a raised *p*H increased whipping power and tended to reduce stability. Henry and Barbour[25] also found better whipping at higher *p*H. They placed the *p*H for maximum stability below 8 and above 10. Barmore[26] found that alkaline salts such as calcium hydroxide, caustic soda and sodium sulphite had little effect on whipping power, whereas *acids and acid salts* considerably increased stability. Of three acid substances investigated, cream of tartar, tartaric acid and acetic acid, the first was most effective in improving stability. There is an optimum *time of beating*[26] for albumen solutions, probably depending on various factors such as speed of whip, etc. If beating is continued beyond this time stability decreases. Moderate *dilution* of egg whites does not greatly affect the volume of whip but tends to decrease stability.[26] Oil and fatty substances decrease the whipping power of albumen.

The Coagulation of Albumen

The coagulation of egg albumen is closely related to its foaming action. In an albumen foam coagulated protein collects at the air/liquid interface, and Ramsden[27] caused complete removal of albumen in a coagulated condition by exhaustively foaming a solution of albumen. The maximum coagulation by foaming is said by Wu and Ling[28] to occur at the isolectric point (*p*H 4·55).

More obvious coagulation of egg albumen is caused by heat. Coagulation ranges of the constituent proteins have been mentioned. The temperature above which coagulation becomes rapid is about 64° C., varying with the concentration and other substances present. Various factors affect the rate of coagulation. Lepeschin[29] reports a marked acceleration by acids and retardation by alkalis. The well-known retarding effect of sugar on the heat coagulation of albumen is discussed by Bancroft and Rutzler.[30] They also state that if egg white is extracted with ether it fails to coagulate even at boiling point.

The nature of the coagulation of albumen does not appear to be well established, as the theory is bound up with the thorny question of the denaturation of proteins. The reaction is monomolecular, its velocity constant, increasing 15 times for a 10° C. rise in temperature.[31] Chick and Martin[32] divide the coagulation into two phases, denaturation (probably polymerisation of the proteins) being followed by agglutinisation. Coagulated albumen can be redispersed in alkali thiocyanate solutions.[33]

The Uses of Egg Albumen in Confectionery

Egg albumen is extensively used in the preparation of marshmallow and nougat. There are many types of marshmallow, and their different physical characters are considerably controlled by the type of colloids used for producing the foam and by the heat treatment to which they are subjected. Egg albumen produces a shorter type of product than the gelatin, and in practice these two colloids are sometimes used in combination. In the manufacture of marshmallow and nougat it is usual to whip up the egg albumen solution alone or with only part of the sugar (or confectioners' glucose) until a good degree of aeration is obtained, and then to pour on the

remainder of the sugar, etc., in the form of a syrup. The texture of the product will obviously be affected by the temperature of this syrup, *i.e.*, whether it is hot enough to coagulate the albumen. Materials such as icing sugar, nuts, fat, etc., can be added after a firm whip has been produced. If they were added earlier, aeration would be impeded.

Provided that a satisfactory and standard quality of albumen is used there is little to go wrong in the preparation of marshmallow and nougat—at least, as far as the whipping up of the albumen is concerned. The albumen requires a sufficient time to dissolve. For flake albumen this is usually overnight. This is insufficient time for any bacterial degradation to occur, provided clean utensils are used and the material is kept cool. Warm water may be used to hasten the solution, but there is an obvious risk of coagulation. Powdered albumen can be brought into solution for almost immediate use. In these circumstances there is clearly less chance of bacterial spoilage and waste.

Egg albumen is used in large quantities by bakers in the preparation of royal icing. An albumen solution is first well aerated in a whisk and sufficient icing sugar added subsequently. The whipping power of the albumen is of obvious importance for the preparation of this type of icing. It also appears that lack of stability in the whip results in poor texture of the icing and consequent poor piping quality. To overcome this tendency acetic acid is often added to royal icing. It has already been shown that acid substances increase the stability of whipped albumen and cause increased surface coagulation.

Meringues and macaroons depend on the whipping power and stability of albumen for their satisfactory preparation. These products retain their shape during baking and during storage only because the albumen is coagulated by the action of the oven heat and, so to speak, solidifies the structure. It is not difficult to imagine how a gelatin whip would behave if baked in an oven, the different behaviour being due to the fact that gelatin melts and does not coagulate at high temperatures.

Albumen as a Clarifying Agent

The clarification of liquids by egg albumen is brought about by causing the albumen to coagulate in the liquid. The flocs formed adsorb or enmesh the colloidally dispersed substances causing the haze and settle out, leaving the liquid crystal clear. Or, at least, that is the intention. In most cases the operation requires a certain amount of skill for a successful result to be obtained.

The fining of wine by albumen does not depend on the action of heat. Coagulation is presumably brought about by the combination of the protein of the albumen with the tannin-like bodies which cause the haze in the wine. The action is a general one for proteins, and gelatin can be used for the purpose.

The clarification of gelatin solutions by egg albumen is largely practised when meat products such as tongue, etc., are packed in glass. In this case the coagulation of the albumen is brought about by heating the stock. The *p*H of the gelatin has an important bearing on the success of the operation. As has already been discussed, albumen does not coagulate so well in alkaline solutions and a gelatin with a high *p*H would prove difficult to clarify for this reason. Another difficulty sometimes experienced is when the flocs of coagulated albumen stick to the sides of the steam-pan and burn.

Substitutes for Egg Albumen

There is at present no material offered at a competitive price which can be considered a substitute for egg albumen, although there appears to be no reason why proteins of similar physical characteristics should not be prepared from other sources than eggs.

Certain confectionery products can be made by using other colloids in place of egg albumen. For example, marshmallow and nougat can be made with gelatin. In such cases the prepared article is different from one made with egg albumen, the difference being due to the different physical properties of albumen and the other colloid. In this sense gelatin, agar-agar, spray-dried whey powder, etc., can sometimes be utilised instead of albumen to prepare similar but different products. Whether this is possible depends on the particular product being made.

It has been suggested from time to time that proteins of a similar nature to egg albumen could be extracted from a number of natural sources. These include soya-bean, fish, blood and whey.

Hiltner[35] describes a process for preparing albumen from animal and fish muscle fibres. Such material is digested for one hour at 65° C. in water of *p*H 4. The insoluble matter is centrifuged off and washed with alcohol. It is then swelled with dilute alkali, treated for a short while at 90° C., and the alkali nearly neutralised with acid. The product, which is water soluble, may be dried before use, and is suggested as a substitute for egg albumen in bakery products. It coagulates only on heating about 100° C.

Woodruff, Chambers and Klass[36] concluded from experiments with soy bean protein that, although this has marked foaming properties, it fails to produce requisite thickening and binding when incorporated in bakery products. It is, on the other hand, wholly unobjectionable and tasteless.

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MONO- AND DI-GLYCERIDES

THEIR USE IN FOOD MANUFACTURE

Mono- and di-glycerides of stearic and lauric acid are being used in ever-increasing amounts by many manufacturers of diverse food products. While triglycerides are plentiful in nature, the mono- and di-glycerides have never been found in natural products. These products, having a hydroxyl-containing group at one end and a fatty group at the other end, are thus compatible with polar and many non-polar materials. They are used in food products because they act as emulsifying agents, thickeners, stabilisers, surface tension reducing agents, texture improvers, homogenisers, binders and protective film-forming media.
Some of the food products in which they are used are breads, cake, nut butters, margarine, shortenings, ice-cream, frozen eggs, salad dressings and dairy feeds.

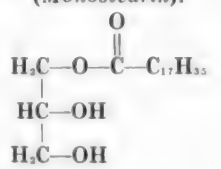
H. BENNETT, F.A.I.C.

TRIGLYCERIDES of higher fatty acids (containing six or more carbon atoms), as is well known, occur plentifully in many natural products such as animal, vegetable and fish oils and fats. Strange as it may seem, mono- and di-glycerides never have been found in fresh, undecomposed natural materials.

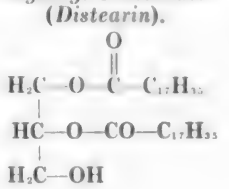
The mono- and di-glycerides, although known in the laboratory for many years, have only become important commercial products in the last eight years. Because they are non-toxic, edible products of a pleasing fatty odour they have been of particular interest to the food industries as well as in other industries.

The most important commercial mono- and di-glycerides are structurally represented as follows:

Glyceryl Monostearate (*Monostearin*).



Glyceryl Distearate (*Distearin*).



General Properties

The commercial mono- and di-glycerides are not pure chemical products. They consist of mixtures of these two glycerides in varying proportions often plus free fatty acids and small amounts of triglycerides with or without small amounts of soaps and salts. The pure mono- and di-glycerides are not good emulsifying agents themselves. Only in admixture with soaps, wetting agents or other surface tension reducing agents, do they exhibit their full peculiar emulsifying and wetting properties, which make them of commercial interest. Because both the mono- and di-glycerides are formed together in the usual commercial syntheses, using various catalysts, the reaction mixture need not be further purified since the finished material, as such, is useful in many products. Thus manufacturing costs are considerably lower than if separation of the mono- and di-glycerides and soap were necessary. The products of this type now on the market are neutral, acid or alkaline, depending on the ratios of free fatty acid and alkali and methods of manufacture.

The commercial mono- and di-glycerides, because of their unique structure, disperse in both aqueous and fatty materials under suitable conditions. They may be classified as hydrophilic lipins. The fatty group shows a marked affinity for fatty materials, and the group containing the free hydroxyls shows a marked affinity for aqueous solutions. They are further characterised by foaming or frothing when shaken with water and their ability to lower the surface tension of aqueous solutions.

When a commercial mono- or di-glyceride mixture is melted and stirred in water a translucent or opaque milky dispersion results. The viscosity of such an aqueous dispersion may be varied tremendously (from a thin liquid to a solid) depending on the concentration and nature of the glycerides. This increase in viscosity lends itself admirably to increasing the suspending power of a medium for insoluble particles.

Mixtures of such glycerides have been produced, unknowingly, *in situ*, for hundreds of years by many bakers and other processors who have used natural glycerides in conjunction with alkali under favourable conditions. Thus the baker who used flour containing natural glycerides and made a dough, using an inorganic baking powder containing bicarbonate of soda or other inorganic salts, inadvertently produced such glycerides in the baking process.

Methods of Production

The following methods have been used to produce mono- and di-glycerides:

1. Glyceryl chlorhydrin + a salt of a higher fatty acid.
2. Triglyceride + glycerol ± catalyst.[1]
3. Glycerol + higher fatty acid + catalyst.[2]
4. Sodium glycerate + higher fatty acid.[3]

Since methods (2) and (3) are the most economical they are generally used in commercial practice.

Since light, colour and freedom from objectionable odour and taste are prerequisite for use in most food products, special techniques have been developed to produce products that are very light in colour and free from objectionable odour and taste.

Commercial glyceryl monostearate is a firm, waxy product at ordinary temperatures. For many purposes its consistency is desirable. In other cases a liquid product is more desirable. In the latter case the laurate, which is fluid, instead of the stearate, is used.

Physical properties of representative commercial types of these products are given below:

PHYSICAL PROPERTIES.

Commercial Glyceryl Monostearate.

Form and Colour: White cream; Waxlike solid.
Melting point: 56-57° C.
Solubility (water, cold): Slight.
,, (water, hot): Disperses completely.
,, (alcohol, hot): Complete.
,, (hydrocarbons, hot): Complete.
*p*H (25° C.): 9·6-9·9 (3 per cent. dispersion).
Specific gravity (20/20° C.): 0·908.
Odour: Faint fatty.

Commercial Glyceryl Monolaurate.

Amber-coloured fluid.
Solubility (water): Disperses completely.
,, (alcohol): Complete.
,, (hydrocarbons): Complete.
,, (oils): Complete.
*p*H (25° C.): 8·8-9·0 (3 per cent. dispersion).
Specific gravity (25/25° C.): 0·979.
Odour: Faint fatty.

Making Emulsions

Emulsions using these glycerides as emulsifying agents may be made in the following ways:

1. The glyceride may be dissolved in the oil phase and water is then added slowly with vigorous mixing; or the oil phase containing the emulsifier may be added to the water.

2. The glyceride may be dispersed in water and the oil phase is then added slowly with vigorous mixing; or the water phase containing the emulsifier may be added to the oil phase.

It is impossible to predict which of these methods will be best to use in a given formula under given conditions. The "rule-of-thumb" plus that second sense, developed by practice in the art, seems to be standard practice for workers who are concerned with commercial emulsions. Not only proper formulation, choice of emulsifier and order of introduction of phases is necessary to obtain a good emulsion. Type of mixing vessel, agitator, speed of agitation, time of agitation, temperature, unsuitable components, etc., etc., are factors which may make or break an emulsion. Whereas a colloid mill or a homogeniser may be helpful in certain cases, in others it may be highly detrimental to use them.

Practical Applications

As previously indicated, the ability of these glycerides to orient themselves at the water-oil interface so that one end of the molecule embraces or is embraced by the oil phase and the other by the aqueous phase makes their use possible in many diversified products.

The addition of small percentages of these glycerides to shortening oils and fats improves the latter markedly, and most of such products now on the market make use of such additions. Margarine is thus improved to give a smoother texture because these glycerides bind the aqueous (milk) phase so that the latter will not separate or "weep" on storage.[4]

Certain water-insoluble materials, which are not readily compatible with aqueous materials, such as lecithin, are stabilised and rendered readily dispersible in aqueous media by the incorporation of varying amounts of these glycerides.[5]

Cakes, which contain more sugar than flour, are greatly improved by the use of small percentages of these glycerides.[6] Here the texture, uniformity and lesser tendency to become stale make these products invaluable.

In the production of casein from milk-whey and yeast by fermentation there is produced a very undesirable froth or foam. It has been found that the introduction of small amounts of glyceryl mono- and di-laurates combats this foam formation very effectively.[7]

The manufacture and packaging of compressed bakers' yeast has also been improved by the use of less than ½ per cent. of glyceryl mono- and di-laurates.[8] By proper introduction in the manufacturing process it prevents lumping of the yeast, which speeds up manufacture and gives a more uniform product. Furthermore, yeast made in this way is extruded more easily, fractures cleanly, and shows a homogeneous texture instead of concentric circles and an uneven surface and break. Cakes of 1 lb. or more are thus made by extrusion without cracking or breaking due to the binding action of the glycerides used.

Improvement of Food Products

Users of natural fats are frequently troubled by fractional crystallisation of their products on cooling. This segregation caused by constituents of different melting points that are present in most natural fats results in poor appearance and other ill-effects occasioned by non-uniformity. The addition of these glycerides to hardened oils and fats has been found helpful in minimising the tendency to segregation of the constituents of such products.[9]

Until recently many manufacturers of peanut butter suffered from complaints of oil leakage in their product, because of sedimentation of peanut particles, with a resultant liberation of oil which rose to the top of the container. Furthermore, such peanut butters have a tendency to stick tenaciously to the roof of the mouth since they are not wetted by the saliva. The addition of up to 10 per cent. of these glycerides to peanut butter has solved these problems. They act as emulsifiers for the oil phase with the saliva and peptise the peanut particles, which greatly reduces the tendency to sedimentation and stratification.[10]

Frozen eggs which are imported and prepared in this country on a tremendous scale have to be "reconstituted" before use by bakers so that they will act like fresh eggs.[11] The addition of these glycerides in frozen eggs enables easy "reconstitution" and gives cakes of finer texture, increased volume and better non-staling properties.

Baking powder for bread has also been improved by the addition of these glycerides.[12] Improved texture, tenderness and keeping qualities result. A slow-acting baking powder consists of these diglycerides, sodium acid pyrophosphate and starch.

Many products of a hygroscopic nature such as beef extract become unsaleable because of moisture absorption. By mixing or coating such materials with these glycerides a continuous film is formed which protects the product against absorption of atmospheric moisture and against oxidation and bacterial attack to some degree.[13]

Ice-cream has also been improved by the use of these glycerides which, when added to the amount of 0·1 to 0·2 per cent., controls the percentage of over-run and because it prevents coarse crystal growth gives a finer texture. It also effects an economy in that it makes the use of egg yolk unnecessary.[14]

Improvement of cream for whipping is marked by the addition of as little as 0·1 per cent. of monoglycerides;[15] non-fattening salad dressings using mineral oil and water are made into stable white emulsions;[16] manufacturers of dairy feeds are producing reconstituted foods from skimmed milk, fats and small percentages of these glycerides.[17]

Summing up, these mono- and di-glycerides of the higher fatty acids have proved to be very useful in various food products by aiding stability and improving texture and appearance. In many cases they have replaced the more expensive egg products, gum tragacanth, etc. Where they have replaced cheaper materials, the proportion used is sufficiently small to make their use economical.

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NEWS FROM THE INDUSTRY

SAUSAGE MAKING PLANT AND MATERIALS

Sausage Binders

There can be no doubt that the excellence of the general quality of sausages is contributed to not only by meticulous attention to manufacturing details, but also to the access which the manufacturer has to scientifically prepared fillers.

Rationing of meat, the inevitable increase of price, and consequent restriction in the choice of cuts, has meant heavier consumption of sausage. These factors, together with the Ministry of Food's grading of sausages, makes essential the use of a suitable sausage binder. The grading of sausage is now quite clearly defined, and has been welcomed by both large and small manufacturers, especially by those accustomed to selling sausage with a high meat content, these having been severely penalised by the "50 per cent. content" restriction. Now they can produce sausage with a 70 per cent. meat content, and this should satisfy their customers.

* * *

A Book of Meat Recipes

There is no doubt that when anyone specialises in any one product they are best able to inform the consumer how to use that product to the best advantage. This is just what has been done in a book, *Dalton's Meat Recipes*, published by Stokes and Dalton, Ltd., the manufacturers of the sausage binder "Nukrisco".

First of all, the reader is told exactly what the product is—*i.e.*, a product of the Manitoba wheat crop, which, on arrival at the Company's mills, is sifted, cleaned and graded to a standardised formula. Untouched by hand, the flour is submitted to special processes during its progress through the machines and ovens, ensuring the retention of the vital goodness of the ripe wheat. The Company prides itself on being the first to obtain for its product the Certificate of the Royal Institute of Health and Hygiene.

The book is chock-full of recipes for meat goods of every description, from all the members of the sausage family to such delicacies as Scotch haggis and pickled venison. The instructions are well conceived, with a view to rapid reference, and they bear the mark of a practical writer on the subject.

The seasoning of meat products is an art in itself, and in this, again, the Company specialises. The homely sausage takes on a poetical tinge when one reads that "rich and rare aromatic spices from Cashmere, from Cathay, the Indies, the Andes and sun-drenched Southern Europe" contribute to its seasoning!

The illustrations clearly indicate the importance of the scale of the operations carried out, and include those of one of the giant ovens, dough mixers, grinders, etc.

This is a book which should be possessed by every manufacturer handling meat products. Apart from the recipes, it contains a large number of practical hints on general procedure.

* * *

The "New Yeastless" sausage binder made by Frank Price (M/c), Ltd., has been evolved to meet the demand for a rusk of high absorbency, without any mealy flavour. Made from the finest wheat, and carefully prepared by a scientific anti-bacterial process, the deleterious after-effects of chemical aeration are avoided, and it will absorb more than 200 per cent. of its own weight in moisture. It will keep perfectly fresh under all conditions and is definitely not a bread rusk.

* * *

Placed on the market some thirty-five years ago, Provost Cricks, according to their makers, R. Robinson and Sons, long since have reached a definite standard, with satisfactory absorbent, keeping and other qualities required for the production of a firm, dry, white sausage.

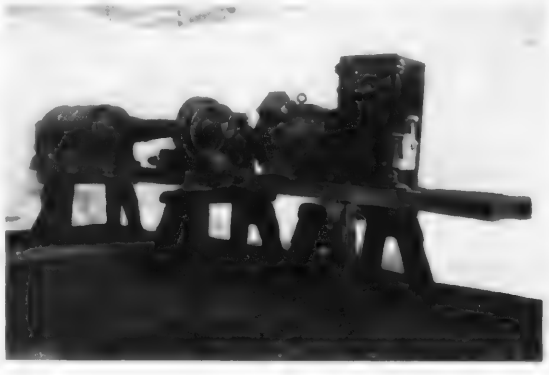
A Filling Machine

The illustration represents an 80-lb. sausage filler, driven by a variable-speed D.C. motor, and is designed to run from 940 to 600 revs. with 8 different speeds to suit the class of sausage required. On ordinary $\frac{7}{8}$-in. diameter sausages this machine fills 80 lb. of meat in 90 seconds. Power required is 1·4 h.p.

The propelling motion is a screw driven by single helical gears running in a gear box with forward and return clutch with variable gearing, so that the plunger returns in 17 seconds, and for this an automatic brake is provided.

The frame is made of steel with a forged steel head, and the plunger has a heavy rubber ring. Automatic stops prevent over-running on either stroke. The barrel-lifting attachment has an automatic stop so that the attendant cannot start the plunger until the barrel is in correct position. The motor can be either D.C. or A.C. with suitable variable speed starter. An automatic clutch will slip at a given overload in case a bone gets into the machine. An anti-spewing device is provided which automatically prevents the pressure in the meat spewing after each skin is filled.

The gear wheels are covered with an aluminium cover. Flexible couplings are provided between the machine and motor, and it is all mounted on a self-contained bed, with ball bearings. Three nozzles are provided, one for large sausages, one for standard $\frac{7}{8}$-in. sausages and one for "Parisiennes" of about $\frac{3}{4}$-in. dia., and when filling "Parisiennes" the speed of the motor is put down to the lowest range at 600 r.p.m.



The makers, H. J. H. King and Co., Ltd., have manufactured Sausage Filling Machines for upwards of fifty years.

Synthetic Sausage Casings

These casings have come into prominence during the last few years. At the time of their first introduction their development was favoured by the scarcity and high cost of animal guts, but although these factors have disappeared at the moment, the uniformity of the synthetic product favours its use.

A new casing, "VITA-Natcherik", is being manufactured, according to a process patented in this and other countries, from animal substances with a skeleton of special fibres, the combination of which reproduces the structure and chemical composition of the animal gut in the closest possible way.

It is claimed to be "boil-proof", and other characteristics are that it takes on smoking excellently and allows of pricking in the boiling.

A sufficient porosity allows the air to reach the filling ("breathing").

This new casing is being made in all diameters from 45 millimetres upwards in the colourless forms as well as boil-proof printed and dyed, and also opaque white for liver sausage.

The manufacturers, Brainos and Co., are now occupied in developing an artificial hog casing in lengths of

100 yards apiece, of all diameters. These, the manufacturers state, will exhibit natural qualities and will be burst-proof, assume a brown colouring when fried and have a pleasant smell and taste.

* * *

Mincing Machines

The range of machines made by the Hobart Manufacturing Co., Ltd., not only includes the regular mincer or breaker-down, but the combination mincer and bowl cutter, and silent bowl cutter. The small manufacturer can find sizes and types suited to his needs. It is interesting to note that the company claims to be manufacturers of the first direct-driven electric mincers.

The "servicing" of equipment is a very vital item to the busy manufacturer, and in this respect the company excels, as they have branches and depots widely spread over the United Kingdom.

* * *

Sausage Transport

Special refrigerated railway vans are run into the private sidings of the factory of Palethorpes, Ltd., for the transport of sausages in hot weather, thus ensuring the delivery of sausages in a factory-fresh state at extreme points in the British Isles. These refrigerated vans are very handsome and form an excellent advertising medium as the wording "Palethorpes Royal Cambridge" is figured in gold lettering against a background of the railway companies' regulation colour. The temperature of the vans is kept at about 42° F.

* * *

Naming Sausages

A cut-to-shape parchment band, prominently printed with a distinctive design and brand name, not only adds to the attractiveness of sausages but also forms a simple and inexpensive sales aid. The band is fixed round each bundle of sausages and is made of vegetable parchment. J. Evershed and Co. (Bow), Ltd., make a feature of these bands.

Steam and Water Mixers

The necessity for a continuous and economical supply of hot water must have been experienced by almost every food manufacturer. We have recently seen quite an ingenious gadget for getting this, called the "Leonard Thermostatic" steam and water mixer. A continuous supply of hot water at any temperature up to 200° F., kept accurately within a few degrees F., is obtained from a supply of steam and of cold water at any temperature and pressure, irrespective of fluctuations, connected with the valve. This represents a considerable economy over the usual crude methods of blowing live steam into cold water. The valve (which is made by Walker, Crosweller and Co., Ltd.) on the bi-metal coil principle, is completely automatic. As an example, a ½-inch mixer will provide 2 to 6 gallons per minute of water at 180° F., with the steam and water pressure about equal, ranging from 5 to 60 lb. per square inch. Apart from the many uses which must occur to the food executive in his actual work, this device is very useful in large establishments when hot water is required for ablution equipment.

* * *

Rubber Latex

As the result of several years of research and development, the Sealex Compounds manufactured by Rubber Latex, Ltd., have been in regular use by firms in this country whose names are household words. The location of the factory is specially favourable for the purposes of distribution and good services.

It cannot fail to be of great interest to the trade to know that a British concern is competent at the present time to supply flowed-in Lining and Cap compounds, and that the concern has sufficient reserves of material to supply the trade for many months to come.

Considerable additions have been nade to the plant and machinery in order to cope with the increasing demand for the compounds.

We understand that until the Sealex Compounds had been successfully developed the home trade requirements for can-sealing compounds had to be imported from overseas. It is, therefore, a particular satisfaction to us that by the enterprise of a British manufacturer a home-produced article is available for use.

* * *

Walworth Limited

The above-named company, in their announcement on another page, point out that, owing to the tightening up of control on all production and supplies, buyers should, in their own interests, specify Government Department symbols and contract numbers on all orders entitled to them. This will expedite delivery of all orders placed for work of national importance.

* * *

"Schisagum"

An interesting booklet, which describes this vegetable gum, has recently been sent us.

Galactanes 28·18 per cent., mannans 59·42 per cent., pentosans 2·75 per cent., albuminoids 5·29 per cent., cellulose 3·54 per cent., and mineral substances 0·82 per cent., is the composition of the vegetable gum which has "Schisagum" for its commercial name. The gum is extracted from cotyledons of vegetable seeds, and particularly from the seeds of the Cyprus Locust Bean, by means of a special refining and crushing process.

This product is described in a handy little booklet issued by the Schisa Gum Company. This booklet explains fully the colloidal thickening properties of the product and its use as a stabiliser in many foodstuffs, such as sauces, mayonnaise and salad cream, etc., and contains some useful recipes.

* * *

A Useful Cement

A good and easily mixed cement for jointing and patching is always a useful thing to have available in the food factory, especially if it is resistant to mineral and organic acids, is strong and sets rapidly without contraction or cracking. Better still, if it has lasting waterproof properties, especially in those departments of factories (such as pickling cellars) where conditions are moist. Heat-proof properties render it still more useful.

A cement which has just been put on the market is claimed to be an entirely new material and consists of a fine powder, which is mixed with an acid-resisting solution, when a plastic cement is obtained, which is applied in the usual way.

This is being marketed by J. H. Sankey and Son, Ltd., under the name of super-acid-resisting cement.

* * *

A New Spray Gun

A recent addition to the range of spray guns manufactured by B.E.N. Patents, Ltd., which have been so widely used by food manufacturers, combining speed of coverage with great economy in the use of materials, is already proving its worth in these days of intense effort to secure maximum production. The latest model owes its success, in a large measure, to the employment of a special principle which utilises high pressure for atomisation, but low pressure for distribution. The result is absence of spray fogging and an exceptionally smooth finish.

The model is available in two types for use with a syphon cup and with a pressure or gravity feed paint container respectively. The working pressure of the former is from 35 to 50 lb. and of the latter from 50 to 75 lb. Both types are available with a range of round or fan spray heads utilising 2, 3½ or 5 cubic feet of air per minute. With the fan head either a vertical or horizontal spray can be obtained by a half turn of the spray head, the width of the spray being regulated by the material adjusting screw. This gun should be of great service to the food industry.

* * *

Power Transmission Appliances

An extract from the Factories Act, 1937, reads: "Every part of the transmission machinery shall be securely fenced unless it is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced." To meet this requirement, Crofts (Engineers), Ltd., make an economical shafting guard consisting of specially impregnated cardboard

tubes split longitudinally along their length to allow for slipping over shafting, and secured together by adhesive tape or metal clips. Should anything come into contact with the tubes such as workmen's clothing, etc., the tubes remain stationary while the shafting revolves inside.

This is but one item in the booklet which the company issued recently. It contains comprehensive information on mechanical power transmission appliances, and belt, rope, VRope, chain and gear drives standardised to meet general industrial requirements. The last section is devoted to general engineering tables, and will no doubt be of interest to power users in all trades. The booklet may be obtained on application to the manufacturers.

* * *

Continuous Band Dryer

The dryer is a continuous automatic unit specially suited for drying materials containing a small percentage of moisture.

The general design is similar to the conventional form of continuous band dryer, but greatly increased capacity is obtained by utilising both sides of the bands for drying. This is done by constructing the bands in the form of a number of trays arranged to tilt at each end of the travel and to deliver on to the returning band below.

In addition to making the maximum use of space occupied, this results in efficient agitation or turning over of the material at regular intervals.

The driving gearing is completely enclosed, and all internal parts are readily accessible by means of hinged inspection doors entirely covering both sides.

The dryer is made by L. A. Mitchell, Ltd.

* * *

Electric Motors

The engineer, with full knowledge of the conditions under which a motor will be required to operate, can choose with certainty which of the various types available will be the most economical, taking into consideration not only first cost, but expenses of operation, maintenance, wear and tear, and useful life.

Newman Motors, however, have developed a single type which would be suitable for almost any application, irrespective of the working conditions.

They claim that their motors can be safely installed in dusty, damp or chemically laden atmospheres; their performance is such that they can frequently be used in place of "High Torque" motors, whilst the exceptionally high power factor and efficiency, especially on partial loads, will usually effect a considerable saving in current consumption.

* * *

Butter Flavours

Although butter and cream flavours have always played their part in the manufacture of foodstuffs, war conditions, with the consequent restrictions on the use of butter, have given these flavours an added importance.

Considerable research has been carried out with a view to producing a perfectly balanced butter flavour for use in confectionery and other foodstuffs. Cumming Parsons, Ltd., have evolved such a flavour, which they market under the name of "Twinlink".

* * *

Butter flavours, mild and strong, for caramels, edible fats, biscuit fillings, biscuits and cakes, ice-cream and artificial cream, and also some new caramel flavours are among the products described and listed in a leaflet issued by W. J. Bush and Co., Ltd. The caramel essences are of differing types and are combinations of caramel and brown sugar flavours, which assist the manufacturer to overcome the handicap of using standardised sugar. A useful formula for caramels is given.

* * *

Adhesives

All food manufacturers are being urged by the makers of adhesives themselves to exercise the strictest economy in their use. In spite of the difficulties in the supplies of raw material, Gloy and Empire Adhesives, Ltd., are making every endeavour to satisfy the requirements of manufacturers, and, in order that the risk of interrupted deliveries may be minimised, their products are being produced at three separate centres.

* * *

John Thompson (Dudley), Ltd.

Messrs. John Thompson (Dudley), Ltd., have made arrangements for clients of their Chemical Plant and Foodstuffs Department to have the same expert service as in the past.

* * *

The Institute of Physics

At the Annual General Meeting of the Institute of Physics held on Wednesday, June 5, last, the following were elected to take office on October 1, 1940: *President*, Professor W. L. Bragg; *Vice-President*, Dr. B. A. Keen; *Honorary Treasurer*, Major C. E. S. Phillips; *Honorary Secretary*, Professor J. A. Crowther; *New Members of the Board*, Professor E. A Owen and Dr. C. Sykes; Professor G. I. Finch (appointed by the Physical Society); and Dr. R. W. Lunt (appointed by the Faraday Society).

* * *

Annual General Meeting

At the Annual Meeting of the London Chamber of Commerce, held on June 6, Sir Geoffrey R. Clarke, C.S.I., O.B.E., was elected President of the Chamber in succession to Sir Alexander Gibb, G.B.E., C.B., LL.D.(Edin.), F.R.S., who retired after three years' service.

The following resolution was unanimously adopted, on the motion of Sir Alexander Gibb, seconded by Mr. A. S. Todd (Gordon, Woodroffe and Co., Ltd.), for transmission to the Government: "That the London Chamber of Commerce in Annual Meeting assembled, recognising that the Government is now in business on a vast scale, and that day-to-day decisions are required from Government, urges, in the strongest possible manner, that the principle of personal responsibility should be substituted for that of conference, committee, departmental and inter-departmental reference, in all those cases where the exigencies of business demand speedy decisions. It is convinced that the arguments which can be advanced in peace-time for a system of check and counter-check are outweighed in war-time by the imperative need for rapid decision."

PERSONAL

Mr. William Thompson

Mr Wm. Thompson, M.I.Chem.E., M.I.Weld.E., has been appointed Chief Engineer of the Magnesium Metal Corporation, Swansea.

* * *

Captain W. A. Ecob

We have been advised that Captain W. A. Ecob, on the staff of Rex Campbell and Co., Ltd., will henceforward look after all the company's publicity matters.

* * *

Mr. L. G. Reid

Mr. L. G. Reid, the General Manager of the Brush Electrical Engineering Co., Ltd., has been appointed to the Board of Brush Coachwork, Ltd.

"FOOD IND. MANUAL"

Orange II

On page 72 of *Food Industries Manual*, 1940, under the heading "Colours for Confectionery", the dyestuff Orange II was inadvertently included in the list of those prohibited by the Public Health (Preservative, etc., in Food) Regulations, made by the Minister of Health.

Orange II is a permitted dyestuff, and Williams (Hounslow), Ltd., the well-known makers of harmless edible colours, point out that they and other manufacturers are supplying it under a definite guarantee of purity.

* * *

Robert Kellie and Son, Limited

In the Canning Section of the *Manual*, page 143, the caption of the illustration of Robert Kellie and Son's Dicing and Slicing Machine which reads, "By courtesy of Lazenby and Ridgewell, Ltd.", is incorrect. The two firms have no connection with each other, and the machine illustrated is solely that of Robert Kellie and Son, Ltd.

INFORMATION AND ADVICE

Marshmallow Powder—Fondant Manufacture—Preserving Fresh Vegetables Sugar Substitutes—Information Supplied—Information Required

Marshmallow Powder

6,302. *I would be much indebted to you if you could oblige me with information as regards making a powdered marshmallow, or perhaps you could give me a cheap recipe for marshmallow powder.*

You may find one of the following recipes useful to you :

(1)	Gelatin	50 lb.
	Finely pulverised sugar	50 ,,
	Albumen	10 ,,
(2)	Albumen	40 lb.
	Gelatin	40 ,,
	Finely pulverised sugar	40 ,,
	Cornstarch	75 ,,
	Gum arabic	12½ ,,
	Salt	½ ,,

Fondant Manufacture

6,410. *I should be glad if you could give me one or two formulas for the manufacture of fondant.*

The following recipe might be tried :

A fondant containing 25 per cent. or so of glucose is better than one with sugar alone.

White crystal sugar	75 lb.
Glucose	25 ,,
Water	4 gal.

Put the sugar and water in the pan and turn on half steam. Stir to assist melting, and, when all is quite melted, add the glucose, set steam on full, and boil up to 240° to 242° F.

Pour the cream into a fondant cream mixer or on to cold marble, sprinkle with a little cold water on the slab, as well as on the top of the batch, to prevent any crust forming. The quicker it is cooled, the better the cream. When, on touching it, the finger leaves a dent on the batch, begin turning it with the spatula. It will go creamy, or opaque (as it will if made in the fondant cream machine); then take out and cover with damp cloths, which mellows the cream.

Preserving Fresh Vegetables

6,415. *Can you oblige us with a recipe for preserving fresh garden vegetables in glass jars? The main type we have in mind will be kidney beans, peas and carrots.*

We would suggest that you consult the *Food Industries Manual* for 1940, which will give you the information you require.

There is a very good section on fruit bottling, which will apply to vegetables, except that the time and temperature of sterilisation will be different; but you will find these under the various headings.

Sugar Substitutes

6,448. *In May 3 issue of* Food Manufacture *you mention a substance which is a partial substitute for sugar in confectionery, and we should be glad if you could let us know where this is obtainable.*

You have published informative and helpful articles from time to time regarding the manufacture of the lines in which we are interested—confectionery cream filling, piping jelly, marshmallow, etc. Some suggestions regarding sugar substitutes and altered formulæ for these lines would be most welcome now that sugar and glucose supplies are so restricted.

The enquirer was put in touch with the people supplying the product in question.

With regard to your second paragraph, we think you will be interested in Mr. O. B. Darbishire's article on "Jam in War-Time" (Food Manufacture, May 3, 1940) and also in Mr. Eric Humphriss' article on "The Inversion of Sucrose" (Food Manufacture, June 1, 1940).

Information Supplied

6,443. *A new invention is being offered for the manufacture of concentrated food cubes, and, being a contractor to various Government Departments, I am desirous of obtaining more information before entering into direct communication with the inventor.*

I am also interested in the manufacture, for military use, of compressed meat soup tabloids, and take the liberty to ask you whether you are in a position to furnish me with publications or books treating this matter, and to give me some indication as to the patents issued.

The necessary suggestions were given.

6,433. *We are having a certain amount of trouble due to the colouring of our triple concentrated tomato sauce. The colour disappears gradually every day, leaving yellow-brown streaks, until it has vanished completely.*

The tomatoes, when brought into the factory, are boiled into pulp and then passed by the automatic sieves. The pulp is put into open pans and is concentrated. The colour is added only a few seconds before taking the pulp out of the pan. It is then filled into tins and is passed through the autoclaves for 30 minutes at 105° F.

We think it may be the concentration of the acid in open pans which kills all the colour we add to the pulp, and we should be glad of your assistance in this matter.

The enquirer was put in touch with a firm who supply a tomato colouring which will withstand boiling in an open pan.

6,317. *In your issue of April 5 you mention a machine for peeling onions. We would be obliged if you could let us have the address of the firm which is making this machine.*

Name and address of manufacturer was given.

6,398. *Will you kindly give me the name of a firm or firms who specialise in equipment for making potato crisps?*

Names of suppliers of this equipment were given.

Information Required

6,399. *As a member of your large list of subscribers I am taking the opportunity of your technical service to enquire whether you can help me with information in regard to the process of freezing large quantities of fresh strawberries in barrels in the portion of 2 to 1, or 3 to 1 of fruit and sugar; what constant temperature is advisable, and whether anything beside sugar is added as a preservative.*

Another problem: I have been seeking information on berry preserves or whole strawberries. Some experts advise that where fresh strawberries are only to be added at the end of boiling to prevent them from bursting they should first be put into a sugar solution to make sure that the centre of the fruit is saturated with sugar, thus preventing trouble afterwards in storage. My information on this point, however, is incomplete.

6,465. *The writer has been selling a commodity called Ham Roll and Chicken and Ham Roll imported from Denmark, supplies of which long since ceased. As the stocks are now completely exhausted and I wish to get in touch with a manufacturer of a similar type of commodity who would be prepared to make this commodity for purchase by the writer under his label, can you assist me in this matter by giving me the names and addresses of firms likely to undertake this business?*

6,477. *We have received an enquiry for export in connection with the drying of sardines, and should be glad if you could give us some information regarding the drying process of sardines.*

The job, as we see it, is that the sardines are put into trays and then these are loaded on to bogies, which in turn are pushed into the drying chamber. Have you any information as to the temperature required to ensure the drying process to be carried out correctly and also the approximate time factor for the above treatment? We should think the sardines would be placed in such a position as to allow for the maximum amount of drying treatment to take place. We would also like to know the types of trays used in this process.

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